STRESS AND COPING IN LECTURING

A study on stability of stress responses,
individual differences and stress moderators

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VRIJE UNIVERSITEIT TE AMSTERDAM

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ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor aan
de Vrije Universiteit te Amsterdam,
op gezag van de rector magnificus
dr. C. Datema,
hoogleraar aan de faculteit der letteren,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de faculteit der bewegingswetenschappen op
donderdag 5 april 1990 te 13.30 uur
in het hoofdgebouw van de universiteit,
De Boelelaan 1105

door

Irene Lydia Dirksje Houtman

geboren te 's Gravenhage

Febodruk-Enschede
1990

Promotor	:	prof. dr. J.F. Orlebeke
Copromotoren	:	dr. F.C. Bakker
		dr. L.J.P. van Doornen
Referent	:	prof. dr. M.W. de Vries

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Stellingen behorende bij het proefschrift

STRESS AND COPING IN LECTURING

a study on stability of stress responses, individual differences, and stress moderators

van Irene L.D. Houtman

1. De fysiologische en psychologische stressreacties van ervaren docenten op het collegegeven zijn niet geringer dan die van beginnende docenten.

2. Individuele verschillen in fysiologische en psychologische stressreacties zijn stabiele persoonskenmerken.

3. De samenhang tussen psychologische kenmerken en fysiologische stressreacties verschilt tussen mannen en vrouwen.

4. Coping is mediërend gedrag.

5. Menselijk copinggedrag bemoeilijkt een betrouwbare toetsing van de relatie tussen fysiologische hyperreactiviteit en pathologie.

6. Er overlijden te weinig vrouwen aan hart- en vaatziekten om betrouwbaar te kunnen vaststellen dat een goede conditie hen daartegen beschermt.

   Salonen, J.T., Slater, J.S., Tuomilehto, J. & Rauramaa, R. (1988). Leisure time and occupational physical activity: risk of death from ischaemic heart disease. *Journal of Epidemiology, 127* (1), 87-94.

7. De belangrijkste opgave voor stressonderzoek in werksituaties is het op valide wijze meetbaar maken van additieve en interacterende effecten van verschillende vormen van fysieke en psychologische belastingen op het individu.

8. De methodieken van het efficientiemodel (Heemstra, 1988) zijn niet alleen bruikbaar voor stressoren die zich kenmerken door mentale belasting, maar ook voor stressoren die emotionele belasting inhouden.

   Heemstra, M.L. (1988). *Efficiency of human information processing - A model of cognitive energetics* -. Proefschrift, Vrije Universiteit, Amsterdam.

9. Een betrouwbare beoordeling van vaardigheden waarbij naast cognitieve ook motorische en/of affectieve componenten een rol spelen, is slechts mogelijk na kalibratie van de beoordelaars.

   Houtman, I.L.D. & Schinkelshoek, D. (1988). *Toetsen van praktische vaardigheden.* Almere: Versluys.

10. De stress van het promoveren - hoewel een éénmalige gebeurtenis - kan wel degelijk nadelige gevolgen voor de gezondheid hebben.

11. 'Notes' zijn noodoplossingen.

12. De 'bevrijding' van het Oostblok leidt in Oost en West tot een overschatting en idealisering van de voordelen van het kapitalistisch systeem.

13. De enige grondige stelling is een heistelling.

Aan Peter
Aan mijn ouders

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Chapter 1
INTRODUCTION

General research perspective

Stress in teaching is a popular theme in educational research. A major reason for this may be that it is found to be associated with health complaints and burnout (e.g. Innes & Kitto, 1989; Kyriacou, 1987; Mykletun, 1984) and has been reported to have negative effects on teaching performance (Blase, 1986). Much of the educational research directed itself to the stressful aspects of teaching. The prevalence of the aspects which are experienced as stressful have, however, found to differ with respect to experience, age, or personality characteristics (e.g. Bergen, Gerris and Peters, 1987; Jordell, 1985; Kyriacou and Sutcliffe, 1978; Veenman, 1984; Vonk, 1982). One of the aspects of teaching which has often been studied in the psychological and physiological stress research is lecturing or public speaking (e.g. Bassett, Marshall and Spillane, 1987; Bolm-Audorff, Schwammle, Ehlenz, Koop and Kaffarnik, 1986; Dimsdale, 1984; Gliner, Bunnell & Horvath, 1982). Within the psychophysiological approach of stress, psychological challenges that induce strong physiological responses are of interest, because an exaggerated physiological response to or a delayed recovery from these stressors is assumed to mark, or even mediate stress-illness relationships (Krantz and Manuck, 1984; Ursin, 1980). The present research takes this psychophysiological assumption as the starting point of the study on stress and coping in lecturing, for which two main objectives are formulated. First, the present research aims to describe the psychological and physiological responses to a lecturing stressor in student teachers, who practice lecturing in a post-secondary institution for a period of about three months. Of special interest in the present research is the adaptation of the student teachers across the practice period. As part of this adaptation will result from psychological (cognitive) processes, this adaptation will be denoted as coping. Second, this research aims to explain individual differences in the stress responses to and coping with the lecturing stressor.

Practice and training are generally found to be associated with significant decreases in psychological and physiological responses to stressors, also to the stress of lecturing (De Jong, 1980; Erdmann, Janke, Kallus and Schlomer, 1984). With respect to the assumption as that physiological hyperreactivity or sustained activation is a marker or mediator of pathogenic processes, the issue of stability in the responses to the lecturing stressor across practice is a crucial one. When hyperreactivity or sustained activation are rather stable phenomena, they can be considered a potential indicator of future health-risk. Coping is, however, also determined by individual characteristics which are assumed to moderate stress-illness relationships (e.g. Lazarus and Folkman, 1984). The moderating potential of several individual characteristics for the psychological and physiological responses to and coping with the stress of lecturing may interfere with the stability of the responses.

Before explicitly going into the way these research objectives will be addressed in the present thesis, first some theoretical approaches to stress and coping are discussed.

Theoretical approaches to stress and coping

A widely accepted definition of psychological stress, form hereon just denoted as 'stress', is that of Lazarus and Folkman. These authors define psychological stress as a relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being (Lazarus and Folkman, 1984, p 19). Central to their interactional approach to the study of stress is the cognitive appraisal and evaluation of potentially stressful stimuli and of the coping processes that consequently occur. Lazarus and Folkman describe three types of appraisal: 'harm/loss', which is defined as injury already done, 'threat', which is defined as potential for harm or loss, and 'challenge', which is defined as potential for growth. Stress may thus have both negative and positive effects. Situations in which harm or loss have occurred are, according to Lazarus and Folkman, always fused with threat, because every loss is also pregnant with negative implications for the future (p. 32/33). An example that may illustrate this for the lecturing situation is the following one. When one has 'lost face' because of a bad lecturing performance, the coming lecture will be feared. Positive and negative effects may, however, both follow, as threat and challenge are not necessarily mutually exclusive. Even after having 'lost face' in a previous lecture, the next lecture may not only entail the risk of loosing face again but may, at the same time, be perceived as a challenge to do a better job this next time.

Ursin (1980), and more recently Dienstbier (1989) emphasize the fact that, in contrast to the often taken view of the stress concept by laymen and even by professionals, stress does not necessarily result in negative effects like poor performance and illness but may result in training or toughening effects as well. Especially with respect to long term effects of stress, negative health outcomes will only result when the psychological and physiological dampening mechanisms fail to effectively reduce the impact of the stressor. The physiological dampening mechanisms consist of specific buffer mechanisms (e.g. pressor reflexes and volume reflexes) and unspecific, generalized changes in effector cells exposed to high levels of transmitters or hormones (e.g. changes in receptor number and binding capacity) (Knardahl and Ursin, 1985). As psychological dampening mechanisms or (psychological) coping, Lazarus and Folkman discriminate two broad categories of mechanisms or strategies that have either a problem-focused or an emotion-focused coping function.

Lazarus and Folkman have worked out an extensive stress theory that has become one of the most cited and used ones. The stress model they present (Lazarus and Folkman, 1984, p 308) shows considerable similarity to a model, which is presented by Jenkins (1979). Their terminology is, however, somewhat different. The difference in terminology probably reflects the fact that the model of Folkman and Lazarus started out of a psychological perspective, whereas Jenkins model was an elaboration of Selye's work, which was physiological in origin. Both models, however, incorporate several levels of approach to describe the stress process within a time perspective. Jenkins identifies four levels of approach: a biological (physiological), a psychological, a social and a socio-cultural level. Stressors, as well as stress responses are defined at all four levels. The stress responses are defined in the three phases of Selye's General Adaptation Syndrome (GAS): an alarm reaction, a defensive reaction and a pathological end-state for each level (Table 1.1). The defensive reactions may

be considered identical with the processes that mediate the immediate and long term (pathological endstate) stress effects as defined by Lazarus and Folkman (1984). Individual differences in the stress and coping responses are at least partly determined by the adaptive capacity, which determines the individual's capacity to cope with the stressor. Examples of the adaptive capacity at the biological level are genetically determined or acquired immunity and physical condition. At the psychological level there are personality characteristics, coping styles and skills. At the social level there is social support, and at the socio-cultural level there are norms and values. The pathological end-state will only occur when effective defensive mechanisms, (partly) determined by the adaptive capacity, fail.

In the model of Lazarus and Folkman (1984), the stress responses are described in terms of immediate and long-term effects for three levels: the physiological, psychological and social level. Immediate effects at the physiological level are described as somatic changes or, when the stressor was intense enough, acute illness. At the psychological level (positive or negative) feelings are defined. At the social level, the authors define social disturbances or group alienation as examples of immediate effects. Long-term effects are chronic illness or longevity (physiological level), morale, functioning (psychological level) and social failure or social change (social level). Moderators are antecedent conditions such as gender, socio-economic status or personality traits that interact with other conditions in producing the outcome variable (Folkman and Lazarus, 1988). Moderators or antecedent conditions may be interpreted as synonymous with Jenkins' 'adaptive capacity'. Mediating coping processes determine which of the long-term effects (positive or negative) occur. Mediators, or mediating processes are to be distinguished from moderators, as these processes are generated in the stressful encounter and are hypothesized to change the relationship between the antecedent and the outcome variable (Folkman and Lazarus, 1988). Illustrating the distinction between mediators and moderators with the Jenkins model, the mediating processes can be considered synonymous with the defensive reaction, whereas moderators can be considered as aspects of the adaptive capacity.

The levels, discerned in both models, are assumed to be interrelated. As illustrated earlier, the perceived threat of the lecturing stressor may result both in physiological and psychological responses. On the other hand, physical stressors (e.g. electric shocks) may cause (immediate or alarm) psychological responses. Interrelations among moderators at the different levels may occur as well. Physical fitness, for example, is consistently found to be related to psychological characteristics of neuroticism, anxiety and extraversion (Eysenck, Nias and Cox, 1982), self-esteem, self-confidence, or self-concept (Doan and Sherman, 1987; Hughes, 1984). The moderators at the different levels may even be causally related as changes in fitness have shown to be associated with changes in self-esteem, self-confidence, and self-concept (e.g. Doan and Sherman, 1987; Hughes, 1984).

Both models do justice to the commonly held belief that stress is a multifaceted and very complex concept, especially when its relation to health is concerned. Many health outcomes have been hypothesized to be related to stress, and the pathways from the confrontation with environmental factors which are appraised as taxing or exceeding one's adaptive or moderating potential (resources) to the manifestation of illness and disease are manifold.

Table 1.1: A model depicting the interaction of stress and the organism (Jenkins, 1979)

	Adaptive Capacity	Stressors	Alarm Reaction	Defensive Reaction	Pathological End-State
Biological Level	State of physique, nutrition, vigor Natural or acquired immunities	Deprivation of biological needs, Excess inputs of physical or biological agents	Arousal-hunger, thirst, pain, fatique Changes in physiological function	General adaptation syndrome Physiological compensation; Shifts in metabolism; Changes in pain threshold	Deficiency diseases 'Exhaustion' Addictions Chronic dysfunction Structural damage
Psychological Level	Resourcefulness, problem solving ability Ego strength Flexibility Social skills	Perceptions and interpretations of danger. threat, loss, disappointment, frustration, or sense of failure or hopelessness, Loss of self-acceptance Threat to security	Feeling of deprivation, boredom, grief, sadness Feelings of anxiety, pressure, guilt Frear of danger	Ego-defenses, denial, repression, projection Defensive neuroses Perceptual defenses, wishes, fantasies, motives, Planning, Problem solving	Despair, apathy Chronic personality pattern disturbances Psychoses Chronic affective disorders Meaninglessness
Interpersonal Level	Primary relationships including family Network of social supports	Social isolation Lack of acceptance Insults, punishments, rejections; Changes in social groups, especially losses	Antagonism, conflict suspicion Feelings of rejection punishment	Defensive, rigid, social relating; Avoidance Assuming sick role Aggressiveness 'Acting out', Enlisting social supports	Chronic exploitation Becoming an outcast Imprisonment Permanent disruption Chronic failure to fulfill roles
Sociocultural Level	Values; Norms and practices 'Therapeutic' social institutions Systems of knowledge and technology	Cultural change Role conflict Status incongruity Value conflicts with important others Forced change in life situation	Communication of concern and alarm Expressive behavior of crowds; Mobilization of social structures	Culturally prescribed defenses, scapegoating, prejudice; Explanatory ideologies Legal and moral system Use of curers and institutions	Alienation, anomie Breakdown of social order; Disintegration of the cultural systems of values and norms

The fact that appraisal, not only of the stimulus itself (primary appraisal), but also of its consequences on the longer term, including the choice of and the effectiveness of one's coping actions (secondary and tertiary appraisal, respectively), is crucial to the study of stress effects. This implies that measuring stress to an intrinsically motivating stressor, and for a prolonged period of time, is essential for a proper understanding of a possible relationship between stress, coping and health. The present research directs itself to the effects of a real life stressor in a longitudinal design. Due to the complexity of the aspects related to stress, the present study is restricted to the study of the effects of a lecturing stressor on the biological and psychological level for a limited period of time.

Stress and coping in lecturing

From interactional theories on stress and coping it must be concluded that the maladaptive effects of a stressor should be studied in situations that are intrinsically motivating, and measurements should be extended for a prolonged period of time in order to measure the effects of coping. The subjects, measured in the present study were students who choose to participate in a teacher education programme in the final year of their study and may therefore be assumed to perceive the teaching profession as potentially challenging.

The complexity of the stress concept and the constraints imposed upon real life research, however, strongly limit the stress measures and measuring procedures that can be used. One is confined to the use of unobtrusive measuring devices. This was thought especially important since the subjects would be repeatedly confronted with the measurements. Because of this, only heart rate (by way of an unobtrusive measuring device), cortisol (in saliva) and subjective anxiety (by way of a retrospective questionnaire) have been measured in the present study as indices of stress.

Subjective report of negative feelings are relatively easy to obtain. Subjective measures of negative affect have often been found associated with subjectively reported ill-health (e.g. Antoni, 1985; Pearlin and Schooler, 1978; Cronkite and Moos, 1984). These associations among self-report measures have, however, been heavily criticized and are suggested to be inflated due to common measure variance (Dohrenwend, Dohrenwend, Dodson and Shrout, 1984; Edwards and Cooper, 1988; Rabkin and Streuning, 1976). Physiological stress measures do not share this problem.

On the basis of psychophysiological and psychosomatic literature, heart rate reactivity and cortisol responses are interesting physiological measures with respect to the maladaptivity of stress and coping. In human subjects , heart rate recovery was found to significantly buffer the effect of hassles on depression and on physical health symptoms (Gannon, Banks, Shelton and Luchetta, 1989). Also, heart rate and blood pressure recovery after standardized psychological stress was significantly delayed in those subjects who reported high life stress scores (Pardine and Napoli, 1983). In two studies on monkeys, it was found that heart rate reactivity to a standard challenge involving a threatening capture and physical handling of the animals was positively associated with the degree of atherosclerosis, determined at necropsy. This association was independent of several other indicators of coronary heart disease (CHD) risk such as cholesterol and blood pressure levels (Manuck, Kaplan and Clarkson, 1983; Manuck, Kaplan, Adams and Clarkson, 1989).

In (psycho)physiological stress models of Henry and Stephens (1977) and Frankenhaeuser (e.g. 1983), the pituitary-adrenal axis which is associated with cortisol secretion, is described as 'conservation-withdrawal response' or 'distress', as opposed to sympathetic induced activation (e.g. catecholamine secretion or heart rate), which may indicate a 'fight-flight' response or 'effort to control'. High cortisol excretion rates have also found to be associated with feelings of distress, 'ineffectiveness of defenses' and 'loss of control' over the stressful situation (e.g. Dienstbier, 1989; Frankenhaeuser, Lundberg and Forsman, 1980; Hofer, Wolff, Friedman and Mason, 1972; Ursin, Baade and Levine, 1978; Vickers, 1988; Wolff, Friedman, Hofer and Mason, 1964). Cortisol secretion has repeatedly found to be associated with disease. In a review on the relation between stress, cholesterol and CHD, Troxler and Schwertner (1985) hypothesized cortisol to be both a direct and indirect mediator in the stress-CHD relationship. Several pathways for cortisol mediation are discussed in their paper. Cortisol has been associated with immunosuppression as well, hereby facilitating inflammatory processes and the progression of other immunological diseases (e.g. Calibrese et. al, 1987, Sklar and Anisman, 1981).

With respect to the present research, the description of the psychological and physiological responses to the lecturing stressor, both at the beginning of, and at the end of the practice period, and its stability across practice are addressed in Chapter 2. Since real life measurements are vulnerable to ecological vagaries that can never be controlled (Dimsdale, 1984), and physiological responses in standardized situations are assumed to be most reliable, the measurement of responses to lecturing will also be determined in a standardized lecturing situation. The associations between the responses in the real life and in the standardized lecturing situation will be addressed in this same chapter.

In Chapter 3, effects of the evaluative potential of audiences on stress responses in lecturing are studied. Evaluative potential may be an important audience characteristic, which may not only be related to stress responses during lecturing, but also to effort expenditure when the audience induces a challenge to perform well, and may (up to some point) result in a better performance.

In the following Chapters, individual characteristics at the biological and psycholgical level are addressed as stress moderators. Sex differences may, however, be expected, not only in the absolute moderator scores, but in the correlational pattern among the moderators as well. Chapter 4 addresses the sex differences in absolute moderator scores, as well as sex specific correlational patterns among the moderators. In Chapter 5, the predictive value of these moderators for reactivity to and coping with the stress of lecturing is studied for both sexes.

Chapter 6 presents data from a pilot study on the reactivity to and (short term) coping with the stress of lecturing in experienced teachers (male supervisors of the student teachers and some of their male collegues). In this latter study, not only the relative importance of the moderators for the explanation of individual differences in reactivity to (and short term coping with) the stress of lecturing is determined, but the explanatory power of these moderators for some indices of objective health risk, and of subjective well-being is determined as well.

Chapter 2
STRESS AND COPING IN LECTURING, AND THE STABILITY OF RESPONSES IN A REAL AND A STANDARDIZED LECTURING SITUATION

Summary

The central issues of the present Chapter are the responses to the stress of lecturing, and the adaptation to this stressor across a period of practice. Special attention is given to the stability of physiological and psychological responses to lecturing across practice in both a real life and in a standardized lecturing situation. Lecturing in the real life situation involved lecturing to a class of students in a post-secondary institution during a practice teaching course. Lecturing in the standardized situation involved lecturing at the training institute to 6 fellow student teachers and 2 members of the university staff. The responses to be measured were heart rate, cortisol excretion and subjective anxiety.

The results indicated that lecturing is stressful for student teachers both in the real and standardized lectures. A significant adaptation in stress responses was found in both lecturing situations across practice. Despite this adaptation, stability appeared considerable, indicating that subjects who were highly reactive before practice were still highly reactive after practice. Apart from a high correlation between the responses measured in the two lecturing situations, both at the beginning and at the end of practice, some significant differences existed between the responses in these two types of lectures. The stress responses indicated that the standardized lecture was experienced as more ego threatening than the real lecture. Also, adaptation in heart rate differed for some of the periods in the two lecturing situations.

Introduction

Physiological, especially sympathetic reactivity to real life or laboratory induced psychological challenges, or a delayed recovery from these challenges is hypothesized to mark or mediate the stress-illness relationship (Krantz and Manuck, 1984; Ursin, 1980). Maladaptive effects of a stressor then are to occur when a person keeps showing exaggerated responses to stressors after repeated confrontation. Long-term stability may, therefore, be considered a prerequisite for hyperreactivity to be considered as predictor of stress-related disease.

Long-term stability of responses to laboratory stressors and of ambulatory measurements is, however, a matter of dispute. The correlations found in the literature differ with respect to the stress task used, and the stress response measured. With respect to the stress response, the highest test-retest correlations have consistently been found for heart rate and systolic blood pressure (Allen, Sherwood, Obrist, Crowell and Grange, 1987; Manuck and Garland, 1980; McKinney et. al., 1985; Seraganian et. al, 1985; Van Egeren and Sparrow, 1989). McKinney et. al. (1985) found that difference scores were less reliable as compared to absolute response values.

The development of pathology is considered to be determined by the effectiveness of the coping process that takes place when individuals are

repeatedly confronted with a specific stressor. Practice and training are generally associated with decreases in response to the stressor (e.g. Erdmann, Janke, Kallus, Nutz and Schlomer, 1984; Ursin, Baade and Levine, 1978). The issue of stability in stress responses across training or practice has, to our knowledge, only been attacked by Seraganian et. al. (1985) who reported considerable stability in the responses to a well controlled laboratory stressor after an intervention of 2 to 3 months only for heart rate and systolic blood pressure but not for diastolic blood pressure and for the catecholamines. To our knowledge, however, it has never been investigated if hyperreactors to real life stressors remain hyperreactors after real life practice in which coping takes place. The issue of the stability in reactivity to a real life stressor over a period of real life practice will be investigated in the present study.

As has been implicated from the stress models, and supported by empirical evidence, measuring stress responses in real life situations is preferable to measuring stress in the laboratory. Several studies indicate that behaviorally elicited blood pressure increase observed in the field, specifically during working hours, appeared to be a far better predictor of pathological manifestations of hypertension than measurements taken in the laboratory, clinic or doctor's office (Devereux et. al., 1983; Parati, Albani, Malaspina and Mancia, 1987; Perloff, Sokolow and Cowan, 1983). Measuring physiological responses in real life is, however, vulnerable to ecologic vagaries that can not be controlled and measurements in a standardized laboratory situation are, therefore, considered to be much more reliable. Correlations between responses to laboratory tasks and field or ambulatory measurements appear to be low (stress responses are often operationalized as differences between stress levels and baselines; Dimsdale, 1984; Floras, Hassan, Jones & Sleight, 1987; Van Egeren and Sparrow, 1989; Warwick-Evans, Walker and Evans, 1988). McKinney et. al. (1985), however, found correlations between laboratory responses and ambulatory measurements to be fair when measuring stress levels, and baseline was used as a covariate (correlations ranged from $r = .09$ to .69, with 28 out of 33 correlations significant at $p < .01$). Ironson et. al. (1989) found baseline blood pressure to be a strong predictor of ambulatory blood pressure (41% of the variance in ambulatory, systolic blood pressure was explained by baseline systolic blood pressure) and reactivity to only one of the laboratory tasks explained some extra but minor variance in ambulatory blood pressure (only 3%). These findings are in line with the above mentioned finding of McKinney et. al. (1985) that absolute response values - which incorporate the baseline - are found to be more stable than difference scores.

In the present study, the correlations between responses in both real and standardized stressor situations, and the correlations which indicate stability of these responses will be determined both for absolute response values and for difference scores.

The present study describes and compares the magnitude of stress responses to a real and a standardized lecturing stressor, using both psychological and physiological stress responses. Student teachers were measured in real life while lecturing to a class of about 20 students in a post-secondary institution. Class size may be one of those vagaries or confounding factors, since audience size has been found to influence the stress responses in public speaking situations (Beatty and Payne, 1983; Latane and Harkins, 1976). As class size

may differ between the lecturing situations for the same subject, as well as between subjects, its effect on the responses to real life lecturing will be determined.

The standardized stressor was a lecture given by these same student teachers in a lecture room at the training institute, to six fellow students and two members of the university staff as audience.

The stress response is operationalized as an increase in heart rate, cortisol excretion and subjective anxiety. To study coping with the stress of lecturing, adaptation in the stress responses to lecturing in both the real and standardized situation across a three month practice period is studied. The stability of the responses to the two lecturing situations will be determined. As to test the validity of the standardized lecture, correlations were calculated between the responses in both lecturing situations, and a control group which did not have real life lecturing practice, is measured twice in the standardized lecturing situation as well. It is hypothesized that the control group will not show a decrement in the magnitude of the response to the second lecture, whereas the practice group will.

Method

Subjects

Sixty five subjects (34 females and 31 males), aged 23 to 32 years, participated in the study. From this group, fifty two subjects (27 females and 25 males) participated in a three months practice period and will be denoted as practice group, and 13 subjects (7 females and 6 males) did not practice and constitute the control group. All subjects (practice and control group) were eligible to participate in a teacher-education programme during the final year of their study at the Department of Human Movement Sciences. All subjects were volunteers. The control subjects are to be considered a waiting list control as these subjects would have their practice period after the second standardized lecture. As there were only a limited amount of ambulatory measuring devices, only 44 subjects in the practice group were also measured in the real life lecturing situation. Due to failures of the apparatus, several heart rate registrations were lost or useless (as only the registration at the beginning of, or at the end of practice was available). Due to the fact that the cortisol analyses only became available to us when the first measurements were already performed, cortisol responses were also available for a subgroup. Table 2.1 shows the number of subjects for who the three responses are available in the different comparisons.

Procedure

Before the start of the teaching practice period, subjects were familiarized with the apparatus to be used and with the measurement procedure.

Before the real and standardized lectures were performed, all subjects (including the control group) followed an introductory course in teaching. During the three months in between the two standardized lectures which followed that introductory course, both the practice and control group followed some general

Table 2.1 Number of subjects in the between-subject comparison of responses for the practice - versus - control group (A), and the within-subject comparison of responses in the real - versus -standardized lecturing situation (B) [1].

A	practice group		control group	
	women	men	women	men
subjective anxiety	27	25	7	6
heart rate	22	17	7	4
cortisol	22	23	7	6

B	real lecture	- versus -	standardized lecture
	women		men
subjective anxiety	22		22
heart rate	9		9
cortisol	8		9

teaching courses at the university. The practice and control group only differed in that the control group did not have practice in between the two standardized lectures, but after the two standardized lectures. In the control group, though, the two standardized lectures were performed across a three month period as was the case for the practice group. The practice group practised real life lecturing at a post-secondary institution in that three month period.

Real life lecturing implied lecturing to a class of at average 20 students in a post-secondary institution. Each lecture lasted for about 50 minutes. Class size

[1] Subjective anxiety scores of the subgroups do not differ from those of the remaining subjects.

ranged from 6 (minimum in the first lectures), or 3 (minimum in the last lectures) to 60 students. The practice period covered at least 20 lectures, performed at this institution within the three months period. In this practice period, the student teacher was instructed and supervised by the experienced teacher whose lectures he or she took over. Measurements were performed on the student teachers during their first real lectures and on all first lectures on consecutive lecturing days at the post-secondary institution. In the present chapter, only the data obtained in the first two, and in the final two real lectures were used in the data analysis.

Measurements were also carried out during two standardized lectures, performed at the training institute at the university. This standardized lecture was a lecture to 6 fellow student teachers and 2 members of the university staff as audience. Subjects had to structure and present a proper lecture. The standardized lectures lasted 30 minutes and were videotaped and discussed with the audience and the student teacher afterwards. The first standardized lecture was given at the beginning of the practice period, whereas the second standardized lecture was performed at the end of the practice period. Real and standardized lectures were not delivered on the same day.

Both the real and standardized lectures had to be prepared by the subjects at home. Although subjects were not completely free to choose the subjects of the lectures for their presentation, they were free to determine the precise content of their lecture when preparing it at home.

When physiological stress responses were measured, an assistant was present to carry out the measurements and to register all activities, undertaken by the subject.

Physiological stress responses

Heart rate was continuously measured using portable heart rate monitors (HRM's) measuring interbeat intervals. The measurement took place from half an hour before the beginning to half an hour after finishing the lecture. Average heart rate was computed over three minute intervals for seven periods before, during and after the lecture. The periods are:

period I: anticipation I (begins 15 minutes before the start),
period II: anticipation II (immediately before the start),
period III: start (the first three minutes of the lecture),
period IV: middle (starts 25 minutes after the start of the real lecture or 15 minutes after the start of the standardized lecture),
period V: end of the lecture (last three minutes of the lecture),
period VI: recovery I (immediately after finishing the lecture)
period VII: recovery II (15 minutes after finishing the lecture).

Cortisol excretion was determined in saliva with a cortisol-125I radio-immuno-assay kit (Farmos Diagnostica, Finland) [2]. Cortisol in saliva appears to be a valid and reliable indicator of the free cortisol in plasma (Evans, Peters, Dyas,

[2] The analyses of the saliva samples were performed by dr. Tilders and his coworkers from the Department of Pharmacology at the Free University, Amsterdam.

Walker, Riad-Fahmy and Hall, 1984; Vining, McGinley, Maksvytis and Ho, 1983). Because free cortisol is measured in the saliva sample, the determinations are unconfounded by the use of oral contraceptives. The cortisol response to a psychological stressor has also found to be unrelated to menstrual cycle phase (Ablanalp, Livingstone, Rose and Sandwisch, 1977). The rate of equilibrium of cortisol between blood and saliva is very fast, being less than five minutes (Vining et.al., 1983). Cortisol that is measured in saliva has shown to be more sensitive to the stress of public speaking than cortisol that is measured in urine (Bassett, Marshall and Spillane, 1987). Saliva was collected just before lecturing and about fifteen minutes after finishing the lecture. As the half life of cortisol in plasma is one hour or more (Frederikson, Sundin & Frankenhaeuser, 1985), it is assumed that the sample, collected before lecturing reflects the adrenal cortical activity when anticipating the lecture. The sample collected after lecturing reflects both the adrenal cortical activity during and after the lecture. About ten minutes before collecting the saliva, subjects were asked to rinse their mouth. Until the moment of saliva collection they neither drank nor ate. After collection of the saliva sample it was immediately frozen on dry ice. When the lectures were finished, the saliva samples were taken to the laboratory and kept at a temperature of -20 ^{o}C until they were analyzed.

For computing individual *baselines*, heart rate measurements and saliva sampling for cortisol baseline determinations took place during a control session after the practice period. During this control session the subjects filled in questionnaires for about 40 minutes. The individual baseline for heart rate was the lowest mean heart rate measured during this session, computed over a five minute interval. Saliva was collected at the end of the control session. The baselines were obtained at about the same time of day as when the responses on the lecturing days were measured.

Psychological stress responses

Immediately after finishing the lecture, the subject was asked to rate, on a 10-point scale, his or her *subjective anxiety* for 10 moments before, during and after the lecture. The extremes on the ten point scale ranged from 'not at all anxious'(1) to 'extremely anxious'(10). The validity of these retrospective anxiety ratings is reported elsewhere (Houtman and Bakker, 1989; see Appendix I). The moments for which anxiety ratings were reported are:

moment 1: during the preparation of the lecture,
moment 2: the evening before the day of the lecture,
moment 3: getting up on the morning of the lecture,
moment 4: on departing for the Institution,
moment 5: on arrival at the Institution,
moment 6: immediately before the lecture,
moment 7: at the beginning of the lecture,
moment 8: at the middle of the lecture,
moment 9: at the end of the lecture,
moment 10: after finishing the lecture.

Data analyses

For the real lecturing situation, average subjective anxiety scores and heart rate responses were calculated over the first two lectures to indicate the stress response before practice and over the last two lectures to indicate the stress response after practice. In this way the influence of incidental circumstances not pertaining to the stress of lecturing itself are minimized. Saliva collection in real life only took place in the first and in the last lecture.

Heart rate and cortisol responses were defined as the increase of these responses with respect to the individual baselines.

As the results will show, the dependent variables were unrelated. Univariate analyses were therefore justified. ANOVA's for repeated measures were used to test the effects of practice and to test differences in responses between the practice and control group. Post-hoc analyses were carried out with the Newman-Keuls test.

Because sex was expected to show main effects on some of the stress responses (see e.g.Lewis, Ray, Wilkinson, Doyle and Ricketts, 1984) sex was introduced as an extra factor in all ANOVA's.

Pearson correlations were calculated to obtain indices for the association between responses in real and standardized lectures, for stability across the three month practice period, and to determine the effect of class size on the dependent variables.

Results

The comparison between the responses of the control and practice group in the standardized lecture will be presented first, followed by the comparison between real and standardized lectures. The effects of class size will be reported in this latter paragraph as well. All ANOVA's used to test main and interaction effects on the physiological stress responses are performed on the difference scores, indicated by the difference between the absolute response values and the individual baseline. Finally the results from the correlational analyses on both absolute response values and on difference scores, indicating the degree of agreement and stability, will be presented. First the interrelation between the dependent variables will be presented.

Correlations between the dependent variables

Correlations among the dependent variables were calculated for both absolute response values, and the difference scores. When correlating heart rate responses and subjective anxiety, the responses at corresponding moments are correlated. When correlating either heart rate responses or subjective anxiety with cortisol, the correlations pertain to all responses, measured during that particular lecture. The reason for this is that cortisol has a considerable latency and the cortisol response, measured at a particular moment in time will reflect previous adrenal cortical activity, and may additionally affect consecutive adrenocortical activation.

The *difference scores* for heart rate and the subjective anxiety scores can be considered unrelated, except for the anticipatory responses in the women. In women, 8 out of the 24 correlations are significant (6 corresponding moments per real and standardized lectures, at the beginning and at the end of practice) and 1 tends to be significant (the 24 correlations range from -.36 to .58). Five of these significant correlations pertain to the anticipatory responses. For the men, only 4 out of 24 correlations tend to be significant (correlations range from r= -.37 to .35).

Heart rate and cortisol responses appear to be somewhat related, especially in the standardized lecturing situation. For both men and women, 24 out of 56 correlations (7 heart rate responses and two cortisol responses per lecture) are significant in the standardized lecturing situation, whereas 6 tend to be significant (correlations range from r= -.10 to .56, 11 at $p < .05$, 10 at $p < .01$, and 3 at $p< .001$). In the real lecturing situation, only 5 correlations are found to be significant (correlations range from r= -.30 to .63).

The cortisol difference scores and subjective anxiety scores can be considered completely unrelated. From the 80 correlations (10 anxiety responses and 2 cortisol responses per lecture for both men and women) only 3 are significant for the real lecturing situation and 2 are significant for the standardized lecturing situation (correlations ranged from r = -.41 to .58 in the real lecturing situation, and r= -.57 to .48 in the standardized lecturing situation).

A similar picture arises when the correlations between the *absolute response values* are considered. No relationship exists between subjective anxiety and heart rate or cortisol excretion, and only few significant correlations occur in the relation between heart rate and cortisol excretion. For the men, 2 out of 24 correlations are significant and 3 tend to be significant (correlations range from -.28 to .65). For the women, only 1 out of the 24 correlations is significant, and 1 tends to be significant (correlations range from r = -.24 to .44). Correlations between the absolute heart rate and cortisol response values are significantly correlated in only 11 out of 56 correlations, in both real and standardized lecturing situations (correlations range from r= -.68 to .88 in the real lectures, and from r= -.32 to .51 in the standardized lectures). For the relationship between the absolute cortisol response values and subjective anxiety, 7 out of 80 correlations are significant in both real and standardized lecturing situations (correlations range from r= -.56 to .62 in the real lectures, and r= -.23 to .52 for the standardized lectures).

Practice versus control group

Figures 2.1 to 2.3 show the responses of the practice and control group in the first and second standardized lecture for heart rate, cortisol, and subjective anxiety, respectively. The mean baseline for heart rate is 72.0 bpm (SD= 11.1), and for cortisol it is 6.4 nmol/l (SD= 4.3).

The repeated measures ANOVA on the *heart rate responses* (2 x 2 x 2 x 7; sex x group x practice x period) shows main effects for practice ($F(1,46)= 10.49$, $p < .01$) and period ($F(6,276)= 139.84$, $p < .001$). The mean heart rate response is lower in the second as compared to the first lecture. The highest heart rate response is measured at period III. The heart rate responses at period II, IV, and V come next. These responses do not differ from each other but are

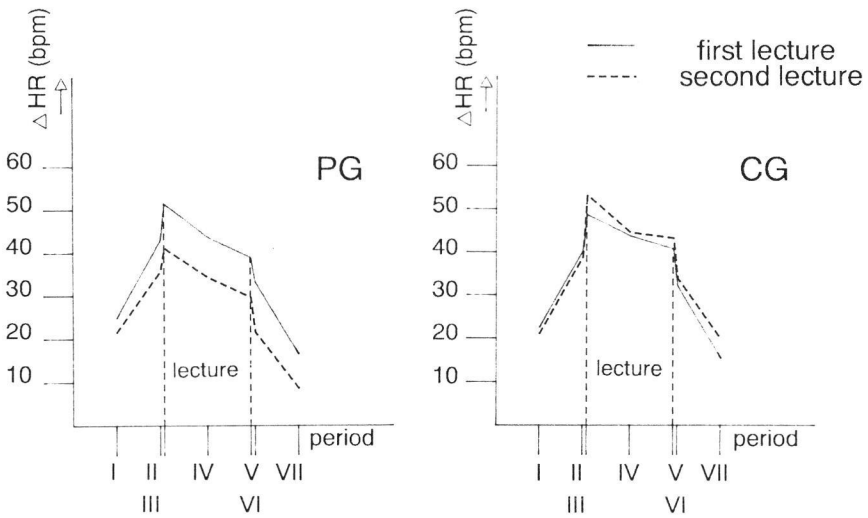

Figure 2.1 Increase in heart rate for the seven periods, in both the practice group (PG, n=39) and the control group (CG, n=11) in the standardized lecturing situation. The periods are explained in the method section.

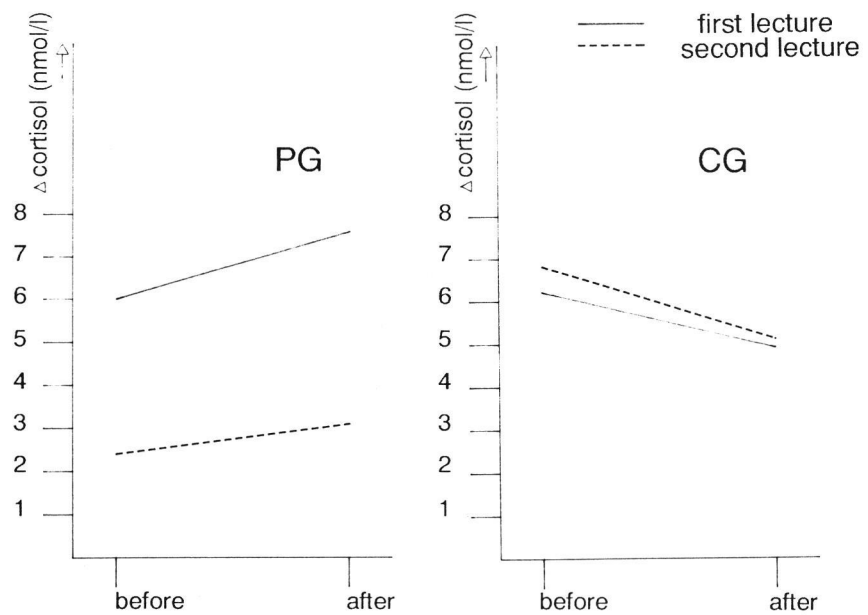

Figure 2.2 The cortisol response before and after the standardized lecture for the practice group (PG, n=45) and control group (CG, n= 13).

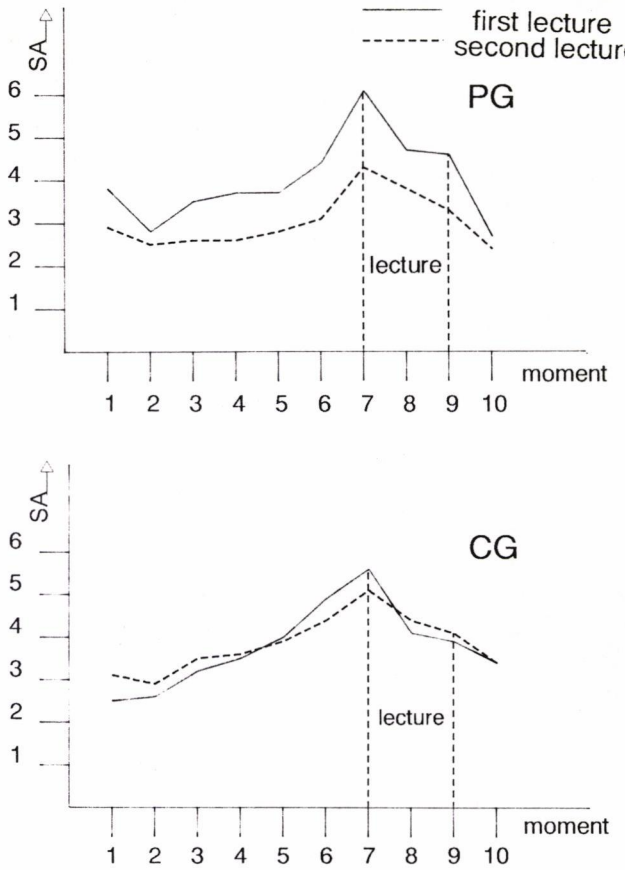

Figure 2.3 Increases in subjective anxiety scores for the practice group (PG, n= 52) and the control group (CG, n= 13) in the standardized lecturing situation. The moments are explained in the method section.

significantly higher than the other responses, before, as well as after lecturing. The heart rate response at period VI is significantly higher than the heart rate responses at period I and VII. The response measured at period VII is the lowest of all. No significant main or interaction effects were found for sex. Significant interactions were, however, found for group x practice ($F(1,46)= 4.62$, $p < .05$) and for group x practice x period ($F(6,276)= 2.16$, $p < .05$). Post-hoc analyses indicate that the practice and control group do not differ in response to the first lecture but that only the practice group shows a significantly reduced response in the second lecture, after practice. Post hoc analyses of the three-way interaction indicate that the practice group shows a significant reduction for all periods except for period I and II.

The repeated measures ANOVA on the *cortisol responses* (2 x 2 x 2 x 2; sex x group x practice x moment) shows a main effect for practice ($F(1,54)= 15.63$, $p < .001$), indicating that the mean cortisol response is lower in the second as compared to the first lecture. A significant interaction is found for group x practice ($F(1,54)= 5.95$, $p < .05$). Post hoc analyses indicate that the groups only differed

in the second lecture. The practice group shows a significant reduction in cortisol response at the second lecture, whereas the control group does not.

The repeated measures ANOVA on the *subjective anxiety scores* (2 x 2 x 2 x 10; sex x group x practice x moment) was performed twice, once on all the scores that were available and once on the scores for the smaller group of subjects whose heart rate responses were available for both the first and second standardized lecture. Because about the same main and interaction effects were found to be significant, the results which are presented here pertain to the responses of the whole sample (52 of the practice and 13 of the control group). Main effects are found for sex ($F(1,61)= 5.04$, $p < .05$), practice ($F(1,61)= 15.62$, $p < .001$) and moment ($F(9,549)= 30.45$, $p < .001$). Females report higher mean subjective anxiety than males and mean subjective anxiety is higher in the first compared to the second lecture. Post hoc analyses on 'moment' indicate that the subjective anxiety scores are highest at moment 7. The subjective anxiety scores for moments 6, 8 and 9 are significantly lower than those for moment 7 but are significantly higher than all other moments. Significant interactions are found for group x practice ($F(1,61)= 4.87$, $p < .05$), for moment x practice ($F(9,549)= 2.95$, $p < .01$) and for moment x practice x group x sex ($F(9,549)= 2.39$, $p < .05$). Post hoc analyses indicate that the reduction in subjective anxiety was only significant for the practice group. The reduction in subjective anxiety appears to be significant for all moments, except for the subjective anxiety reported for moment 2 and 10. Apart from the finding, already noted above, that the subjects in the control group did not show a significant reduction, whereas the practice group did, and that women reported higher scores than men, post hoc analyses on the interaction for moment x practice x group x sex did not reveal significant sex differences, interacting with group, practice or moment.

Real versus standardized lecturing

Class size [3] can be considered a rather consistent characteristic of the educational setting at the post-secondary Institution, as the correlation between class size at the beginning and at the end of the practice period is found to be high ($r= .93$, $p < .001$). Class size was only significantly related to the heart rate responses, especially the responses before and during the lecture. For the men, the correlations for the periods II to V are significant (correlations range from $r= .46$ to $.52$, $p < .05$, except for the correlation for period III after practice, which tends to be significant: $r= .37$). For the women, the correlation is only significant for the heart rate response at the start of the lecture at the end of practice, $r= .43$, $p < .05$).

The responses to the real lectures were measured in a subgroup of subjects from the practice group (see Table 2.1). The responses of these subjects in the standardized lecturing situation, before and after practice are comparable to those, shown in Figures 2.1 to 2.3. The responses, measured in the real lecturing situation are shown in Figures 2.4, 2.5 and 2.6 for heart rate, cortisol, and subjective anxiety, respectively. The mean heart rate baseline for this group of

[3] Class size had a high kurtosis, and was considerably skewed. After inspection of the normal probability plots, as furnished by the BMDP5D program, class size was transformed to attain normality by:

$-1/\sqrt{(\text{class size})}$

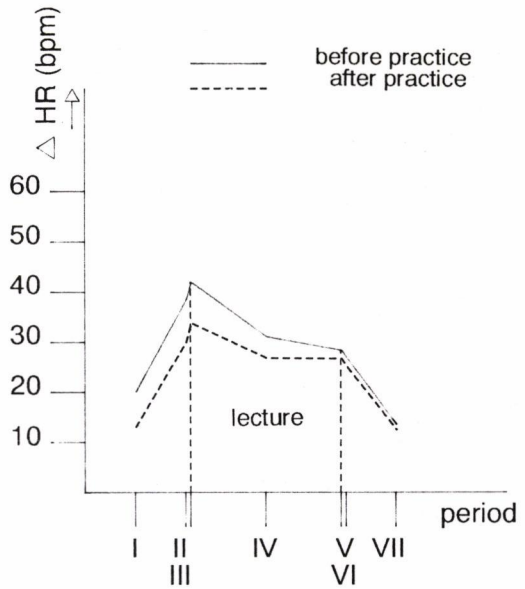

Figure 2.4 Increase in heart rate during seven moments in the real life lecturing situation (n=18). The periods are explained in the method section.

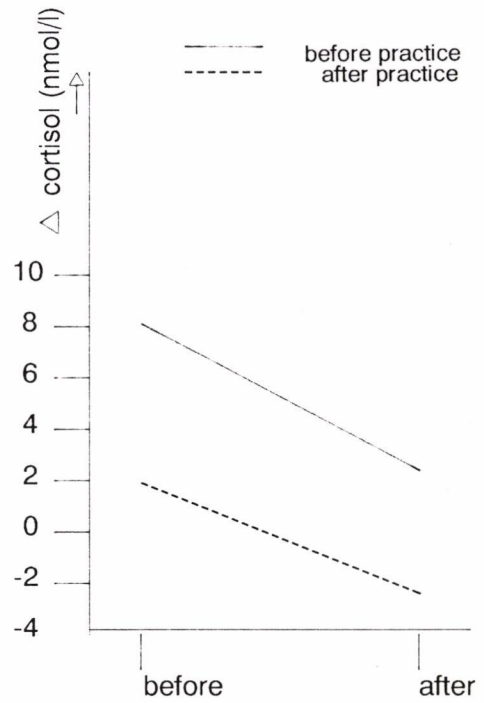

Figure 2.5 Increases in cortisol, secreted in saliva, collected before and after lecturing in the real lecturing situation (n= 17).

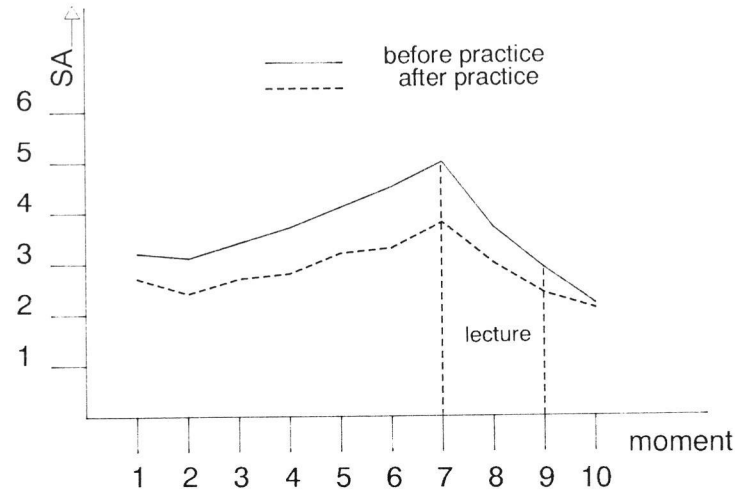

Figure 2.6 The subjective anxiety scores, obtained in the real life lecture (n= 43). The moments are explained in the method section.

18 subjects is 73.5 bpm (SD= 8.8). For the group of 17 subjects, the cortisol baseline is 5.6 nmol/l (SD= 4.0) and 8.9 nmol/l (SD= 5.9) for the cortisol measurements in the simulated and real lecturing situation respectively. The fact that two different baselines are reported for cortisol in real and standardized lectures has to do with the fact that cortisol shows diurnal variation and that, because of this, a second baseline was determined for some of the subjects. Cortisol peaks early in the morning (at about 0700 h), and shows a steep decline towards a stable minimum that is reached somewhere between 1000 and 1100 h (Bassett et. al., 1987; Evans et. al, 1984; Fibiger et. al., 1986). Although all simulated lectures were presented after 1100 h, some of the real lectures were scheduled early in the morning (before 1100 h). When this was the case, a second baseline was determined as reference for the cortisol response, measured in the real lecturing situation.

The repeated measures ANOVA on the *heart rate responses* (2 x 2 x 2 x 7; sex x type of lecture x practice x period) shows main effects for practice ($F(1,16)= 10.65$, $p < .01$), for period ($F(6,96)= 81.12$, $p < .001$), and for type of lecture ($F(1,16)= 13.08$, $p < 0.01$). As main (and interaction) effects for practice and period are comparable to those, presented above, attention will only be directed to main, and interaction effects of 'type of lecture'. The main effect of 'type of lecture' indicates that the mean heart rate response in the standardized lecture is significantly higher as compared to the real lecture. With respect to 'type of lecture', however, significant interactions are also found for type of lecture x period ($F(6,96)= 6.31$, $p < .001$) and for type of lecture x practice x period ($F(6,96)= 3.59$, $p < .01$. Post hoc analyses indicate that only the heart rate responses before and during the lecture are higher in the standardized compared to the real lectures. Post hoc analyses of the three-way interaction show that, before practice, the heart rate responses at periods I to V are higher in the

standardized lecture. After practice, the heart rate responses at periods I to VI are higher in the standardized lecture. In the standardized lecture, no significant reduction is found for the responses in period I and II, whereas for all other moments the reduction is significant. In the real lecture, the reduction is found for the responses at periods I, II and III, whereas it is not found for the other moments during and after lecturing.

The repeated measures ANOVA on the *cortisol responses* (2 x 2 x 2 x 2; sex x type of lecture x practice x moment; n= 17) shows main effects for sex ($F(1,15)= 7.63$, $p < .05$) and practice ($F(1,15)= 11.12$, $p < .01$). The males show a greater mean cortisol response than the females and the mean cortisol response is significantly lower after practice. An interaction is found for type of lecture x moment ($F(1,15)= 11.95$, $p < .01$). Post hoc analyses indicate that the cortisol responses before lecturing do not differ between the real and standardized lectures, whereas after lecturing, the responses in the real lecture are significantly lower.

The repeated measures ANOVA on the *subjective anxiety responses* (2 x 2 x 2 x 10; sex x type of lecture x practice x moment; n=43) shows main effects for sex ($F(1,41)= 4.55$, $p < .05$), for type of lecture ($F1,41)= 6.61$, $p < .05$), for practice ($F(1,41)= 19.60$, $p < .001$) and for moment ($F(9,369)= 30.32$, $p < .001$). Apart from the main effects that were also found in the ANOVA on subjective anxiety scores described above, the mean subjective anxiety score appears to be higher in the standardized as compared to the real lectures. With respect to 'type of lecture' a significant interaction is found for type of lecture x moment ($F(9,369)= 12.92$, $p< .001$). Post hoc analyses indicate that the subjective anxiety scores for the moments 1, and 7 to 10 are higher in the standardized lectures as compared to the scores for those moments in the real lectures.

Correlations between real and standardized lectures, and stability across practice

All correlations, presented in this paragraph are only determined for the practice group. The correlations between the responses in the real and standardized lectures are calculated separately for the responses measured before, and those measured after the practice period. As there are no main or interaction effects for sex on heart rate, men and women are taken together with respect to the heart rate responses. These correlations are shown in Tables 2.2 to 2.4.

The correlations in these Tables are considerable for the heart rate responses, both absolute and difference scores, and subjective anxiety. The correlations are low for cortisol, although it must be noted that the number of subjects is rather small (n= 8 for the women, and n= 9 for the men). Even for cortisol, though, both the direction and the size of the correlations, calculated for absolute and difference scores, are comparable.

Stability of the absolute and difference scores in both the real and standardized lecturing situation are shown in Tables 2.5 to 2.7.

Heart rate responses show considerable stability across the three month practice period in both the real and standardized lecturing situation. It has to be noted that, again, both absolute responses values and the difference scores appear to be equally stable. Cortisol responses indicate considerable stability, but only for the standardized lecturing situation. For cortisol, comparable stability

Table 2.2 Correlations between the heart rate responses (absolute response values and difference scores) in the real and standardized lecturing situation.

heart rate responses				
period	before practice		after practice	
	abs	diff	abs	diff
I	.52*	.53*	.46*	.40*
II	.60**	.58**	.83***	.80***
III	.70***	.73***	.82***	.81***
IV	.68***	.69***	.76***	.70***
V	.56**	.58**	.66**	.55**
VI	.22	.29	.50*	.37'
VII	.65**	.58**	.68***	.58**

' .05<p<.10; *p<.05;**p<.01;***p<.001

Table 2.3 Correlations between the cortisol responses (absolute response values and difference scores) in the real and standardized lecturing situation.
For abbreviations see Table 2.2

cortisol responses				
	before practice		after practice	
	abs	diff	abs	diff
women				
before	.37	.20	.69*	.79*
after	-.15	-.30	.47	.20
men				
before	.42	.26	-.38	-.11
after	.67*	.61'	.49	.16

Table 2.4 Correlations between the subjective anxiety scores in the real and standardized lecturing situation.
For abbreviations see Table 2.2

subjective anxiety scores				
moment	before practice		after practice	
	women	men	women	men
1.	.50**	.53**	.16	.67***
2.	.42*	.35*	.48*	.41*
3.	.28'	.62***	.62***	.42*
4.	.19	.47*	.46*	.44*
5.	.18	.63***	.48*	.34'
6.	.32'	.57**	.69***	.20
7.	.24	.47*	.74***	.26
8.	.34'	.44*	.75***	.38*
9.	.13	.38*	.44*	.16
10.	.34'	.58**	.11	.67***

Table 2.5 Stability for heart rate responses (absolute response values and difference scores) in the real and standardized lecturing situation.
For abbreviations see Table 2.2

stability in heart rate responses				
period	standardized lecture		real lecture	
	abs	diff	abs	diff
I	.48***	.34*	.60***	.49**
II	.66***	.59***	.59***	.57***
III	.68***	.60***	.76***	.76***
IV	.72***	.64***	.72***	.65***
V	.65***	.52***	.80***	.75***
VI	.64***	.44**	.72***	.67***
VII	.62***	.51***	.61***	.50**

Table 2.6 Stability for the cortisol responses (absolute response values and difference scores) in the real and standardized lecturing situation. For abreviations see Table 2.2

	stability in cortisol responses			
	standardized lecture		real lecture	
	abs	diff	abs	diff
women				
before	.68***	.78***	-.04	-.40
after	.35'	.33'	-.38	-.47
men				
before	.10	.10	.23	.14
after	.48*	.46*	.52'	.64*

for both absolute response values and difference scores is found as well. Subjective anxiety does appear to be stable, especially in the real life lecturing situation. For the standardized lecturing situation, though, stability in subjective anxiety scores appears to be considerable for the moments 5 to 10.

Discussion

Both psychological and physiological stress responses indicate that lecturing imposes a severe load on the student teachers, especially at the beginning of their teaching experience. The observed magnitude of increase in heart rate immediately before, during and immediately after lecturing is in agreement with the increases in heart rate found when delivering public (real life) speeches reported by Bolm-Audorff et al (1986).

From a health perspective, the stability of the physiological stress responses was considered a prerequisite for hyperreactivity or sustained activation to mark or mediate pathological processes. The stability of the heart rate responses (both absolute and difference scores) and subjective anxiety scores in the real and standardized lecturing situations, and cortisol in the standardized lecturing situation, appeared quite satisfactory. An explanation for the low stability of

Table 2.7 Stability for the subjective anxiety scores in the real and standardized lecturing situation.
For abbreviations see Table 2.2.

stability in subjective anxiety scores				
moment	standardized lecture		real lecture	
	women	men	women	men
1.	.23	.68***	.62***	.77***
2.	.04	.23	.38*	.30'
3.	-.15	.20	.52**	.20
4.	-.04	.19	.40*	.34'
5.	.41*	.16	.61***	.51**
6.	.48**	.28'	.55**	.54**
7.	-.08	.35*	.49*	.18
8.	.22	.34*	.49*	.32'
9.	.11	.19	.42*	.33'
10.	.33*	.43*	.33'	.30'

cortisol in the real lecturing situation can be found in an aspect of this lecturing situation that could not be properly standardized, i.e. the time at which the subjects were scheduled for real life lecturing. It is a common physiological principle that high blood levels of hormones like cortisol exert inhibitory influences on their own production via hypothalamic and hypophysic stimulation. Responses will be smaller when baselines are higher. As was mentioned in the Results section, cortisol shows a strong diurnal rhythm and peaks early in the morning (about 0700 h) and returns to a rather stable minimum after about 1000 to 1100 h. As the time at which the subject presented their real lecture was out of control, it happened that only 10 subjects started their first and last lectures either early in the morning or after 1100 h. The other subjects presented either their first lecture early in the morning and the last lecture after 1100 h, or the other way around. When stability was recalculated for this group of ten subjects (men and women taken together), all correlations are positive and both difference scores and the absolute cortisol responses before and after lecturing are highly significant (correlations range from $r = .30$ to .79; three out of four correlations are significant, 1 at p .05, 2 at $p < .01$). This indicates that cortisol responses, measured in a real lecturing situation can be reliably determined, provided that one samples the responses at about the same time of day, especially when samples have to be collected before 1100 h.

Special notice has to be given to the fact that the correlations, indicative of stability and agreement of absolute response values and those on the difference scores, were about the same in magnitude for both heart rate and cortisol. This finding is not in line with those of McKinney et. al. (1985), who found that difference scores were less reliable as compared to absolute response values. The present findings indicate that differences scores may be as indicative of pathology as absolute response values. For hormonal responses, though, diurnal variation has to be taken into account.

The correlations between real and standardized lectures are also quite satisfactory. Again, no difference is found between the correlations calculated for the absolute response values and those calculated for the difference scores. Only for cortisol low correlations are found (again, both for the absolute response values and for the difference scores). This can, however, be very well explained by the poor standardization of the time at which the subjects started lecturing in the real life situation.

These findings are corroborated by the finding that cortisol could be reliably determined in the real life situation when only the responses of those subjects who lectured at about the same time before and after practice were considered, and by the fact that the control group did not show adaptation in cortisol, whereas the practice group did.

In the practice group, all three stress responses in both the real and standardized lecturing situation appeared to be sensitive to real life practice, whereas no reduction was found for the control group. Interestingly enough, the ANOVA's on all responses show at least one significant effect for 'type of lecture'. The subjective anxiety scores for preparing the lecture, during and after the lecture are found to be higher in the standardized lecture as compared to the real lecture. The heart rate responses before and during the lecture are all higher in the standardized situation and the reduction in heart rate across practice does not take place for the same periods in the standardized as compared to the real lecturing situation. Also, cortisol responses are lowered only after the real lectures. This latter finding may, however, be explained by the fact that the standardized lecture lasted for 'just' 30 minutes, indicating that the response after the standardized lecture more strongly reflects the adrenocortical response just before and at the start of the standardized, but not of the real lecture. As an explanation for the main picture of these 'type of audience' effects, however, a difference in stressor characteristics like the duration of the speech, size or status of the audience in the real and standardized lectures seems likely. The duration of the speech is not a very likely explanation, though, since the heart rate responses in the present study are in good agreement with those reported by Baldwin and Clevenger (1980), who used an impromptu speech of only three minutes. This impromptu speech was held under one of two conditions: the speech was either addressed to a 'large' audience of eighteen students, or only to two other speakers and an assistant. As in the present study, the speech delivered to the small audience resulted in a higher heart rate response at the beginning of the speech compared to the one delivered to a greater audience. Baldwin and Clevenger do not give an explanation for the effect of audience size as they had expected larger audiences to impose more stress. As was expected from the literature, the present data indicate that class size was positively related to the increase in heart rate responses to real life lecturing. This finding also suggests that as the audience size is smaller in the stand-

ardized lecturing situation, the responses must be expected to be smaller. This was, however, not the case. Latane and Harkins (1976) showed that not only the size but also the status or 'evaluative potential' of the audience contributes significantly to the tension experienced. In the present study the audience present at the standardized lecture was rather small but consisted of fellow student teachers and members of the university staff who would evaluate the lecture afterwards. The audience in the real lecture was larger but 'merely' consisted of a supervisor and students who were not familiar with the subject matter to be presented by the student teacher. A higher evaluative potential of the audience in the standardized lecture may explain why higher heart rate responses and subjective anxiety scores are found for this lecturing situation as compared to real life lecturing, and may also add to the finding that cortisol excretion remained high in the standardized lecture. A study on the effect of the 'evaluative character' of an audience on the stress responses will be described in the next Chapter.

Some differential stress responses were found in the present data for the male and female subjects. They especially occur in the cortisol responses and in the subjective anxiety scores. The male subjects show a greater cortisol response compared to the women, but only in the real lecturing situation. Vining et. al. (1983) reported comparable findings but attributed this sex difference to the lower cortisol level of the men at the start of the study. In the present study the men also showed a lower baseline for cortisol than the women (mean baselines for men and women were 5.7 nmol/l (SD= 2.95) and 7.2 nmol/l (SD= 5.20) for the standardized lecture and 6.1 nmol/l (SD= 3.20) and 11.1 (SD= 7.03) for the real lecture, respectively). These sex differences only reached significance for the real lecturing situation ($t= 2.51$, $p < .05$).

The higher subjective anxiety scores reported by female subjects is consistent with the literature (Frankenhaeuser, Von Wright, Collins, Von Wright, Sedvall and Schwahn, 1978; Hatch and Leighton, 1986; Houtman and Bakker, 1989; Lewis et. al., 1984). This is often explained as a socialization to male/female roles, in that it is accepted for females to show more self disclosure. Despite these higher subjective anxiety scores, females are suggested to deal with psychological demands in a more 'economic way' (Frankenhaeuser at. al., 1978). Several studies report a hyporeactivity of females to a real life stressor with respect to adrenaline responses (Frankenhaeuser et. al, 1978; Van Doornen, 1986). Given the lower CHD-risk in women, Van Doornen (1986) suggests that a closer analysis of this sex difference and the way behavioral characteristics are related to these and other physiological changes in stress situations will contribute to our knowledge of the mechanisms mediating between behavior and CHD-risk.

Apart from sex differences, important individual differences both with respect to the magnitude of the responses and the adaptation across practice can be shown in the present study. In Figure 2.7 an example of individual differences in the heart rate response of two male subjects is graphically illustrated. These individual differences in response to the stress of lecturing will be addressed in Chapter 5.

On the basis of the present data it can be concluded that lecturing is stressful for student teachers both in the real and standardized lectures. The standardized lecture appeared to be a reliable and valid replacement of the real lecturing situation. Especially with respect to cortisol, standardization of the time

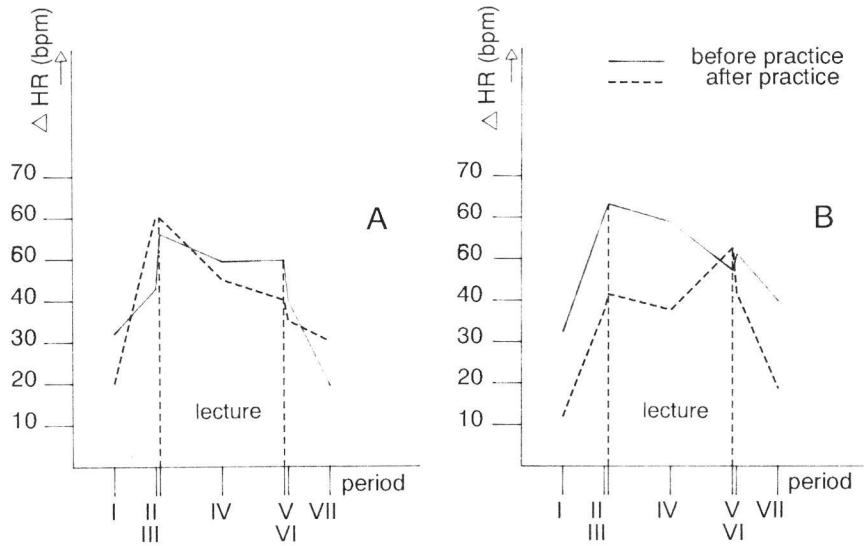

Figure 2.7 Individual curves representing the increase in heart rate in the real lecturing situation, before and after practice for two subjects (A and B)

at which measurements take place appeared to be of great importance for the determination of a reliable response. Apart from considerable correlations between the responses in the two lectures, some significant differences exist between these two types of situations. Differences in 'evaluative potential' of the audiences in the two situations may account for these 'type of lecture' effects.

Adaptation to the lecturing stressor occurs in both situations for the group as a whole but important individual differences in the magnitude of the responses and reduction after practice can be observed. Our data, however, indicate that there is a high probability that those persons who are high reactors before practice, will still be the high reactors after practice. This stability adds to the credibility of the relevance of stress responses for disease development. To gain insight into these stable differences in reactivity and their significance for stress-related illness, the measurement of (real) stress effects should not only be extended in time, but should also incorporate other indices that have importance for 'toughening' effects of repeated exposure to stress. Dienstbier (1989) points to the role of personal characteristics and coping styles and to performance outcomes in relation to physiological reactivity, coping and health.

Chapter 3
AUDIENCE STATUS EFFECTS ON STRESS AND PERFORMANCE IN LECTURING

Summary

In the present study, the effects of audience status on heart rate, subjective anxiety and performance were studied in a lecturing analogue situation. Twenty five subjects participated in the study, all subjects had completed a teaching practice course. For only 21 subjects the performance measure was available. The subjects were allocated to either a control condition, a 'low-status' audience condition or a 'high-status' audience condition. The groups in the three conditions were matched for sex and for several person characteristics.

Audience effects appeared to be marginal for heart rate and performance, and absent for subjective anxiety. Audience condition did not significantly affect the heart rate responses when the analyses were performed on 21 subjects, but showed a significant interaction with period when the analyses were performed on the responses of all 25 subjects. In this latter case, the lowest heart rate responses during lecturing were found in the control condition as compared to the two audience conditions. Heart rate remained significantly higher during the presentation, only in the high-status audience condition. The performance scores tended to be lowest in the control condition as well, but tended to be highest in the low-status audience condition. Although these data suggest some kind of curvilinearity, this could not be shown in multiple regression analyses with the (simple) heart rate entered first and the squared heart rate next.

Introduction

Real life public speeches can result in substantial increases in subjective anxiety and in heart rate responses of at average fifty beats per minute (Bolm-Audorff et. al., 1986; Houtman and Bakker, 1987). Simulated public speaking situations can, however, also cause considerable stress responses (Baldwin and Clevenger, 1980; Droppleman and McNair, 1971; Karst and Most, 1973, Knight and Borden, 1979). In the previous Chapter, the subjective anxiety scores and heart rate responses in the standardized lecturing situation were even significantly higher as compared to those in the real lecturing situation, despite a smaller audience size. As an explanation for this finding, it was hypothesized that the standardized lecturing situation was experienced as more ego-threatening since the audience in this situation consisted of peers and two members of the university staff who had authority on the subject matter the student teachers had to present and on the way the student teachers applied didactic principles in their presentation. The audience in the real life situation, on the other hand, consisted of 'mere' students and the supervisor. The present study aims to test the effect of evaluation potential of the audience on stress responses in a controlled lecturing analogue situation, without having to account for differences in audience size. The possible effects of evaluation apprehension will, however, not be confined to physiological and psychological (emotional) measures as lecturing performance will be measured as well.

The influence of the presence of others on individual behavior is a classical topic in social psychology. The best known theory explaining audience effects on human behavior is that of Zajonc, who applied Hull's drive theory to social phenomena (Zajonc, 1965, 1966). Zajonc proposed that the presence of others acts as a source of generalized drive that energizes the dominant response tendency to the exclusion of competing responses. Heightened drive will, thus, facilitate task performance on simple tasks, but will impair task performance on difficult or complex tasks. Cottrell (1972) extended Zajonc's theory, by claiming that the presence of others will particularly influence drive when evaluation apprehension is perceived. Other 'social facilitation and inhibition' (SFI) theories are the self-presentational theory (Bond, 1982) and the attentional conflict hypothesis (Sanders, 1981 a,b). Bond attributed social facilitation to the performer's active regulation of his public image and social impairment to embarrassment, following anticipated or perceived loss of public esteem. When people are motivated to make a preferred impression on audiences, anxiety will arise when unsatisfactory evaluative reactions are perceived or imagined (Schlenker and Leary, 1982). Sanders, on the other hand, attributed social impairment to an attentional conflict. On the one hand, an individual may be motivated to make a good presentation before an audience but on the other hand this audience may be experienced as a distraction. When more attention is directed to the audience at the cost of attending to the task, increased evaluation apprehension will result in impaired task performance. Within this view, social facilitation will only occur when a positive effect, resulting from an increased drive outweighs the negative effect of attentional distraction. From these theoretical notions, it may be concluded that physiological responses which are indicative of drive will increase when an audience is present. This may result in or be associated with an increase in performance, probably up to a point where anxiety is experienced (self-presentational view), or the audience acts as a distraction.

A meta-analyses on 241 studies which investigated social facilitation effects showed that the presence of others had only small effects on human task performance and that evaluation potential did not reliably determine the size of the total mean social effect (Bond and Titus, 1983). The small mean effect sizes reflect, in part, the large number of effects directionally opposite to the mean and, both across and within studies: evaluation potential seemed to reduce the mean effect nearly as often as it magnified it, indicating that evaluation apprehension may induce both social facilitation and inhibition. In most studies, however, the magnitude of the drive that is experienced when performing in the presence of evaluation apprehension is unknown. Most of the studies did not use both performance and physiological measures when manipulating evaluation apprehension, and in the studies that had done so (e.g. Cohen and Davis, 1973; Henchy and Glass, 1968), no apparent attempt was made to determine inter-measure correlations. In the meta-analysis by Bond and Titus, the issue of inter-measure correlations also remained undiscussed. Assuming that the physiological responses that are reported in the meta-analysis are indicative of drive, the meta-analysis indicates that during complex tasks, evaluative others and expert evaluators significantly raise a performer's physiological drive, whereas peer presence per se has no effect and the presence of non-evaluative others even reduces it. In contrast, the quantitative performance measures show the reverse pattern: for complex tasks, the mean performance is somewhat better when the audience has no evaluative potential as compared to when they

have an evaluative role. In the presence of peers, performance in complex tasks is even significantly increased as compared to performance measured before an expert audience.

In the present study, audience status was manipulated in order to induce differences in the evaluative potential of the audience. The effects of audience status were studied on heart rate, subjective anxiety and performance, in a simulated analogue of the lecturing situation. Especially heart rate may not just indicate negative stress effects as suggested in the Introduction of this thesis, but may be indicative of drive, and act as energizer which benefits performance as well. Heart rate has been associated with motivational incentives or active coping in studies of, for example, Fowles (1983), and Obrist et. al. (1978). This suggests that the higher heart rate responses in the standardized situation that were found in the previous Chapter may have acted as physiological drive and may have been associated with a better performance. As the reliability of the instrument, used to evaluate lecturing performance in the real and standardized lecturing situation by way of didactic criteria, was unsatisfactory (see Appendix II), the present lecturing situation was constructed in a way that lecturing performance could be reliably determined by way of content criteria. Since several of the subjects had also participated in the measurements that were reported in the previous Chapter, a check could be obtained as to the validity of the responses which were measured in the present analogue of the lecturing situation for real life lecturing.

It is hypothesized that heart rate responses and subjective anxiety scores before and during lecturing are higher when audience is present, and highest when the status of the audience is highest. Lecturing performance does not necessarily follow this linear increase as especially the high-status audience may have a distracting or anxiety provoking effect, resulting in impaired performance.

Method

Subjects

Twenty five subjects participated in this study. All 25 subjects (13 female and 12 male) were student at the Faculty of Human Movement Sciences, and had participated in a teacher training programme during the final year of their study. The experiment took place after the subjects completed the teacher-education programme, so that the subjects could be considered 'trained' on the task. From only 21 subjects the performance scores were determined since lecturing performance could not be obtained for four subjects due to problems with the recorded material. For 8 of the subjects, measurements were also available for both the real and standardized lecturing situation, before and after practice, as reported in the previous Chapter.

Procedure

The experiment took place in a teaching room. Subjects had to present three lectures, the first presentation was treated as a practice trial (this was, however,

not told to the subjects). For the practice trial, each subject received the same short article to prepare and to present. During this practice trial, no audience was present. The measurement procedure, however, was the same as in the experimental trials.

After the practice trial, two experimental trials were performed in which the lectures were presented in one of the three audience conditions. The two experimental trials differed in that subjects were allowed either a very short period of time (10 minutes) or a much longer period of time (30 minutes) to prepare the lecture. The order of the preparation time was balanced across subjects. The intention of having subjects prepare with either limited or ample preparation time was to manipulate task difficulty. This manipulation, however, appeared to have no effect on any of the dependent variables and for this reason, no attention is paid to this manipulation any further.

Before each presentation, subjects were confronted with a short article about some general topic. The fact that the articles were new to the subjects and were within the scope of their interest was checked for all subjects. These assumptions appeared valid. All subjects received the same articles. After first reading the article aloud the subject had to prepare the lecture (in either 10 or 30 minutes). During the preparation the subject was instructed to sit down, whereas the presentation had to be performed in a standing position. During the presentation the subject was able to use a black-board or overhead projector to illustrate his or her points. Eight minutes were allowed for the presentation. Subjects were explicitly instructed to present the information in such a way that an audience would be able to get a clear picture of the main topics discussed in the article. All lectures were video-recorded.

The manipulation of audience status was a between-subject condition. Subjects were assigned to one of three audience groups. The audiences consisted either of two students (low status audience), or two members of the University staff (high status audience). The control group performed without an audience. The experimenter was present during the preparation and presentation of all lectures, she instructed the subject and performed all video recordings. The audience was only present during the presentation of the lectures and was not allowed to ask questions (the subjects were, however, not told that the audience would not ask questions). The audience was introduced to the subject before the presentation had to begin, but after the preparation period.

The audience groups were balanced on sex, social anxiety, type A behavior, extraversion and physical fitness. These characteristics had been determined on a separate control day, before the present experiment was conducted. The way in which these characteristics were measured will be described in Chapter 4.

When the subject completed a series of questionnaires for about 40 minutes, their heart rate was measured in order to obtain a standardized baseline. The individual baseline was the lowest heart rate over a five minute period, measured during this questionnaire session.

Dependent measures

Heart rate was continuously measured using portable heart rate monitors which measured interbeat intervals. Mean heart rates were computed over three minute intervals for the following periods:

period I : from 8 to 5 minutes before the end of the preparation period;
period II : the first three minutes of the lecture;
period III : the last three minutes of the lecture;
period IV : immediately after finishing the lecture
period V : during a recovery period, 5 to 8 minutes after finishing the lecture.

Immediately after the presentation subjects were asked to rate their *subjective anxiety* on a ten-point scale, ranging from 'not at all anxious' (1) to 'extremely anxious'(10). They were asked to report their subjective anxiety for the following moments:

moment 1: before the beginning of the lecture, just after the preparation
moment 2: at the beginning of the lecture
moment 3: at the end of the lecture
moment 4: after the lecture presentation

Performance scores for both presentations were calculated from analyses of the videotapes, using a checklist. The checklist score could range from one to ten. Five fellow staff members were asked to make an outline for each article used in the study. From these outlines a checklist was constructed. The lectures were analyzed with these checklists by two raters (interrater reliability = .93). A performance score was calculated for each presentation by averaging the checklist scores assigned by the two raters.

Data analysis

For the heart rate responses, differences were calculated between the absolute response values and the individual baseline. All analyses on heart rate were performed on these difference scores. To test the effects of audience status, an ANOVA is used with presentation number and period (heart rate) or moment (subjective anxiety) as repeated measures. As sex differences may be present in the responses to lecturing, the data are first tested for sex effects. Post-hoc analyses were carried out using the Newman-Keuls test.

Pearson's product-moment correlations were calculated to determine the associations between heart rate responses, subjective anxiety scores and performance. Multiple hierarchical regressions were performed to determine the predictive power of heart rate and subjective anxiety for the lecturing performance. In order to test for curvilinearity in the relation between performance and heart rate, the heart rate response measured at the periods during lecturing was forced into the first step and the square of that heart rate response, together with subjective anxiety were entered next.

Results

For 8 of the subjects, measured in the present study, the responses were also available from the real and standardized lectures. Correlations among the responses, measured in the lecturing situations of present and previous Chapter will be presented first as they reflect the validity of the measurements in the

present study for real life lecturing. The correlations that are calculated for the heart rate responses are shown in Table 3.1.

The heart rate responses measured in the present and previous study are considerably interrelated [1]. The correlations between the subjective anxiety indices will not be shown, as only four of the 32 correlations were significant, but negative ($p < .05$). In spite of the small number of subjects in this subsample,

Table 3.1 Correlations between the heart rate responses, measured in the first and second presentation (p1, and p2) of the present study and corresponding moments, measured in the real (RL) and standardized (SL) lectures, before and after practice, as reported in the previous Chapter (n= 8). Note that the first period of the first heart rate response, measured in the present study, did not exactly match the anticipation period(s) measured in the real and standardized lectures. The correlations presented here pertain to the first anticipation period, as measured in the previous chapter.

	present study - periods -									
N=8	**I**		**II**		**III**		**IV**		**V**	
	p1	p2	p1	p2	p1	p2	p1	p2	p1	p2
previous study										
SL 1	.32	.19	.77*	.47	.62*	.63*	.72*	.71*	.76*	.74*
SL 2	.82**	.68*	.75*	.45	.41	.33	.23	.16	.60	.33
RL before	.86**	.85**	.80**	.52'	.70*	.44	.29	.17	.70*	.66*
RL after	.60'	.70*	.84**	.56'	.58'	.28	.10	.28	.63*	.20

' $.05 < p < .10$; * $p < .05$; ** $p < .01$

it can be concluded that the heart rate responses, measured before and during the presentation, but not the subjective anxiety scores, validly reflect the responses that were measured in real and standardized lecturing situations, as have been reported in the previous Chapter.

The ANOVA's on the dependent variables show no main effect for sex, nor a significant interaction between sex and type of audience. As a consequence, sex is left out of the analyses to be reported below. The ANOVA's on heart rate responses and subjective anxiety scores were performed on both the whole

[3] There were 18 subjects for whom heart rate responses in the standardized lecturing situation were available. Calculating the agreement between the heart rate difference scores in both situations for these eighteen subjects, all correlations were found significant, both for the relations between responses of the first and second standardized lecture, and the first and second presentation. The correlations range from r= .42 to .82.

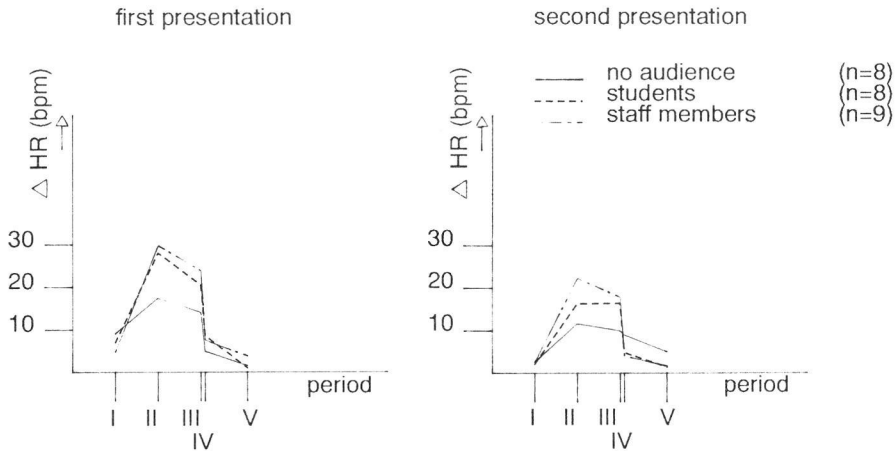

Figure 3.1 Heart rate responses at different periods before, during and after the first and second presentation.

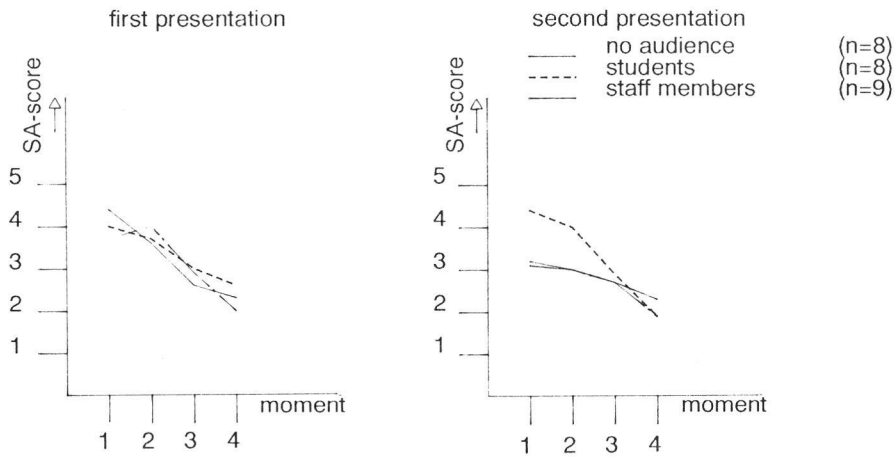

Figure 3.2 Subjective anxiety scores (SA), reported for different moments at the first and second presentation

subject sample of 25, and on the sample of 21, for whom performance scores were available as well. For the subjective anxiety data this did not make any difference, but for the heart rate responses it did. For heart rate, therefore, both analyses are presented.

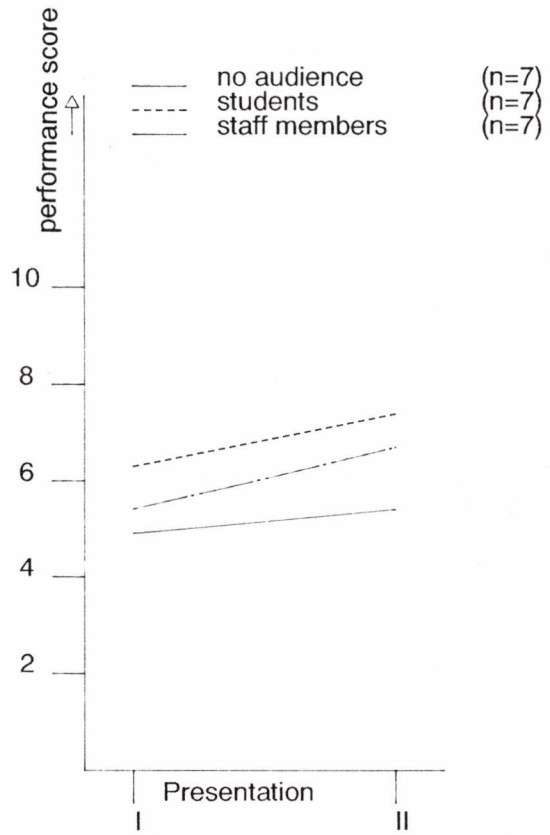

Figure 3.3 Performance scores on the first and second presentation

Heart rate responses

The mean heart rate responses on the first and second presentation for the three audience groups are presented in Figure 3.1. The ANOVA on the (repeated) heart rate responses for the whole and the smaller sample (type of audience x preparation time x subjects x presentation number x period; 3 x 2 x 25 x 2 x 5), shows a main effect for presentation number ($F(1,22)= 21.44$, $p < .001$), indicating a lower mean heart rate response at the second presentation. Period also shows a main effect ($F(4,88)= 57.01$, $p < .001$), indicating a significantly higher heart rate response at period 2 as compared to the other periods. Period 3 is found to be lower than period 2, but higher than periods 1,4 and 5. These latter periods do not differ from one another. A significant interaction is shown for presentation number x period ($F(4,88)= 4.23$; $p < .01$) as well, indicating that the heart rate responses at periods 1, 2, 3 and 4 are significantly lower during the second presentation. Only for the analyses on 25 subjects, a significant interaction is found for 'type of audience' x period ($F(8.88)= 2.13$, $p < .05$), indicating that the heart rate responses at period 2 are higher in both audience conditions as compared to the control condition. At the

end of the lecture, only the heart rate responses in the high-status audience condition are still significantly elevated as compared to the control condition. When the repeated measures ANOVA is performed on the 21 subjects this interaction is no longer significant ($F(8,72)= 1.73$, $p= .108$).

Subjective anxiety scores

The subjective anxiety scores for the first and second presentation are shown in Figure 3.2. The ANOVA on the subjective anxiety scores only shows main effects for presentation number ($F(1,22)= 6.14$, $p < .05$) and for moment ($F(3,66)= 16.77$. $p < .001$). The mean subjective anxiety score during the second presentation is significantly lower compared to that of the first presentation, and subjective anxiety scores at moments 1 and 2 are significantly higher compared to moments 3 and 4.

Performance scores

The performance scores (n=21) for presentation 1 and 2 are shown in Figure 3.3. A significant main effect is shown for presentation number ($F(1,15)= 11.80$, $p < .01$), indicating an increased performance in the second presentation. The main effect of type of audience tends to be significant ($F(2,18)= 2.93$, $p= .085$). Subjects in the 'no audience' condition tend to perform worst, whereas subjects in the 'low-status' audience condition tend to perform best.

Correlational analyses

Subjective anxiety scores and heart rate responses at corresponding moments in time appear to be unrelated. All simple correlations between the heart rate responses and performance scores are negative, but only the first heart rate response, measured during the first anticipation reaches significance ($r= -.46$, $p < .05$). The multiple regressions indicate that neither the squared heart rate response, nor the subjective anxiety scores during lecturing explain any extra variance in the performance score.

Discussion

The results from the present study give only marginal support for the interpretation of the data in Chapter 2, that it was the higher evaluative potential of the audience in the standardized lecturing situation that caused the higher responses in the standardized lecturing situation as compared to the real lecturing situation. The audience effects on the stress responses only appeared to be significant for heart rate, and only when the whole group of subjects were considered. With respect to performance, the audience effects tended to be in the expected direction. Since the subjects were trained in lecturing, the lecturing task in the present study can be considered a simple task. In accordance with the prediction from traditional SFI theories for simple tasks, audience presence tended to facilitate performance. The increase in heart rate during the performance of the lecturing task, however, is not significantly related to the performance scores. With respect to the relation between heart rate and performance, the Figures 3.1 and 3.3 suggest that the performance even seemed to be somewhat deteriorated in those subjects who had the highest heart rate responses during lecturing, suggesting a curvilinear relation between heart rate and

performance. Curvilinearity for the relation between heart rate and performance, however, was not significant for the subgroup of 21 subjects.

One of the explanations for the minor significance of the manipulations in audience status may be provided by the self-presentational theory. The results for the subjective anxiety responses might be interpreted as that the audience conditions in this study were not perceived as threatening or as having the potential to induce embarrasment or negative feelings. The absence of audience effects on the subjective anxiety scores may, however, also be interpreted as that the anxiety thermometer might be too little refined or sensitive to reveal any effect of the present manipulations, except the very profound ones such as the reduction in subjective anxiety within and across the presentations. As a consequence of the small effects on subjective anxiety, the range in scores was limited and all correlations which were calculated for subjective anxiety, may have been inflated by the small variances.

Since the audience effects are found to be small, audience (status) effects may additionally have been blurred by individual differences in person characteristics. Matching on relevant person characteristics prevent systematic confounding by these characteristics, but person characteristics have repeatedly found to interact with the presence of an audience. Pruyn (1986), for example, found that only the high anxious subjects showed higher heart rates in the presence of an audience, whereas the low anxious subjects did not show any audience effects at all. Possible effects of person characteristics as predictors for the stress responses to lecturing will be discussed in detail in Chapter 5.

A significant finding of the present study was the stability for the heart rate responses. Despite the fact that the responses were found to be less pronounced as compared to the responses in the previous Chapter, and despite the manipulations of audience status between subjects in the present study, significant correlations were found for those subjects who were measured in all three situations (and were even more pronounced when the stability just considered the heart rate responses in the standardized lecturing situation). As noted above, the absence of significance in correlations for subjective anxiety may have been due to the small range in subjective anxiety scores, measured in the present study. The stability in heart rate across the studies can be considered to corroborate the findings from the ANOVA's that the manipulation of audience status in the present study was only marginally effective.

The change in mean heart rate response, subjective anxiety and performance scores across the two presentations is a very significant finding. On the basis of the present study it is, however, impossible to tell if this effect is a consequence of relaxation, habituation, learning, or a combination of these. Neither the audience presence or status, nor the stability of the heart rate responses were, however, found to be effected by the changes in responses within and across the presentation.

Chapter 4
SEX DIFFERENCES IN STRESS MODERATORS

Summary

In the present Chapter sex differences are studied with respect to stress moderators. Sex differences in both the absolute scores on, and interrelations between characteristics like physical fitness, personality traits, Type A behavior and coping styles are studied. All these characteristics are considered potential moderators in the stress-illness relationship. It becomes apparent that there are several reasons to investigate these relations for men and women separately.

Seventy seven subjects (40 men and 37 women) participated in this study. Sex differences were found in the absolute scores on some of the characteristics. Sex differences were not apparent when just considering correlations among physical fitness, and the personality characteristics of neuroticism, anxiety and extraversion, but only showed up in the correlations when Type A behavior and the coping styles were considered. The possible implications of these findings for a sex specific stress-illness relation are discussed.

Introduction

In recent years interest has been shifting from investigating the impact of stressors on individual stress responses to factors that moderate the immediate and long term effects of stressors. Characteristics, like personality characteristics and coping styles are attributed a crucial role as moderator in the processes resulting in these stress effects.In the present Chapter, some of the interrelations between moderators at the biological and the psychological level will be clarified. Within the psychological level in the approach to stress effects (Jenkins, 1979; Lazarus and Folkman, 1984), both general personality traits, and more (problem-) specific, learned or trained styles of coping may act as moderators. Trait-like individual differences predispose people to specific coping behaviors, leading to a more or less consistent style of coping. The distinction between personality traits, coping styles and coping behaviors then, is one of generality or level of abstraction (Fleishman, 1984). As will be made apparent below, there are several reasons why -especially- the relationships among the moderators should be investigated separately for men and women.

Sarason and Smith (1971, in Magnusson, 1985) already stated that sex is perhaps the most frequently differentiating organismic variable. In a recent paper Eisler, Skidmore and Ward (1988) criticized the research in stress and coping in that it has, in their opinion, remained relatively blind to the possibility of significant sex-related differences in the appraisal of, and coping with stressful events. The critique of Eisler et. al. (1988) is not fully justified for the whole field of stress research. Psychophysiological research in this area, which aims to clarify the mechanisms that link stress to pathological processes and disease, for example, has paid a lot of attention to sex specific responses to and coping with stress, especially Frankenhaeuser and her associates, and Van Doornen (e.g. Frankenhaeuser, Dunne and Lundberg, 1976; Frankenhaeuser, Lundberg and Forsman, 1980; Rauste-von Wright, Von Wright and Frankenhaeuser,

1981; Van Doornen, 1986; Van Doornen and Van Blokland, 1987; Van Doornen, 1988). The general finding in this research area is that women respond to stress in a hyporeactive way as compared to men, especially with respect to the adrenaline excretion. Because sympathetic activation is supposed to link stressors to coronary heart disease (CHD), these observations may have relevance with respect to the sex differences in CHD risk (e.g. Eliot, 1979; Krantz and Manuck, 1984; Van Doornen, 1988). Men are at greater risk for CHD than women (Haynes, Feinleib and Kannel, 1980).

Sex differences in health outcomes are, however, not confined to CHD. Mortality rates are higher for men at all ages and for all leading causes of death (life expectancy is 5 and 7 years more for women; from Statistics for the population in the Netherlands and in the USA, respectively; CBS, 1988; Verbrugge, 1985). On the other hand, morbidity rates and health service use are higher for women (Verbrugge, 1985). Verbrugge concludes that differential perception and evaluation of symptoms for men and women, and sex differences in their readiness and ability to take therapeutic actions, may account for the higher morbidity rates and health service use for women. It is suggested that women take action when confronted with health problems, especially the minor ones, at an earlier stage than men do.

In psychosocial research, the general strategy for investigating sex differences in the perception of stress, health related outcomes and coping, has mainly been concerned with the different frequency of men and women reporting stressful life events or the use of specific coping behaviors. Women generally report more stressful life events and health symptoms (e.g. Georgas and Giakoumaki, 1984; Lester, Posner and Leitnes, 1986). Astor-Dubin and Hammen (1984) found that women reported behavioral coping responses more frequently than men, whereas cognitive coping responses are used with similar frequency by both men and women. Also, it has been reported that women generally seek more social support than men do (e.g. Hart, 1988; Pearlin and Schooler, 1978).

A problem, however, in interpreting sex differences in stress, coping and health related outcomes on the basis of self-report questionnaires or interviews is that women have shown to be more open than men (Hatch and Leighton, 1986). This implies that women are more ready to report their feelings than men are. This might be considered a coping style in itself but could also be regarded as a report artefact (Levenson, Hirschfeld, Hirschfeld and Dzubay, 1983), or as a consequence of sex-role socialization experiences (Buck, 1981; Georgas and Giakoumaki, 1984). Considering coping patterns, i.e. the way in which for example seeking social support or expressing one's emotions are related to other coping styles or to stable personality characteristics, for males and females separately, might be an interesting alternative in the study of sex specific coping.

With respect to the stress-illness relationship, the relation of the different coping styles to the coronary prone Type A behavior or to stable personality traits that are found to be indicative of malfunctioning in men and women on the long run, are of special interest. A recent study by Hart (1988) reported sex differences in coping behaviors that were related to Type A behavior. Hart found social support seeking to be negatively related to Type A behavior in men but not in women.

Stable personality traits, especially neuroticism and extraversion, have frequently been shown to be long term predictors of health problems (e.g. Denney and Frisch, 1981), burnout (McCranie and Brandsma, 1988), and coping effectiveness, determined in prospective studies (Costa, McCrae and Norris, 1980; McCrae and Costa, 1986; Parkes, 1986). Neuroticism has been found to relate positively to health problem scores, burnout and ineffective coping, whereas extraversion has been negatively related to burnout and positively to coping effectiveness. Neuroticism and extraversion may therefore be considered as significant long term predictors of ill-health.

Both neuroticism and extraversion show consistent patterns across age and sex (Eysenck and Long, 1986; Zuckerman, Kuhlman and Camac, 1988). These traits may therefore not be very useful in discriminating between sex specific coping processes, mediating the stress-illness relationship. Coping styles, on the other hand, may be useful in this respect.

Some findings from the psychophysiological literature support the suggestion that moderators are differently associated with physiological health-risk indicators which may mediate the stress-illness relationship for the two sexes. Despite a higher adrenaline response in the males, Van Doornen and Van Blokland (1987) found no sex differences in cholesterol level and in the cholesterol response to a real life stressor. Cholesterol level and response of the men but not of the women, could, however, very well be predicted by depression and achievement orientation (a stable characteristic that is considered to be an aspect of type A behavior). The results that were found for the men (but not for the women) fitted nicely into current models describing the relationship between stress and CHD (Van Doornen, 1988).

The present study aims to describe the interrelations between personality traits and coping styles, separately for men and women. As general personality traits, neuroticism, extraversion and anxiety will be measured. The coping styles that will be measured are attitudes to seek social support, express one's emotions, actively solve problems, to show palliative or avoidance coping responses, to respond in a depressive way or to have comforting cognitions. Also Type A behavior will be measured as a behavioral style that is strongly related to coping behavior.

Aerobic or physical fitness is a biologically defined characteristic that has frequently been associated with a lower incidence of CHD and is hypothesized to be related to coping with stress or illness, and as such may also be of interest to the present line of research (for recent reviews on this topic see Powell, Thompson, Caspersen and Kendrick, 1987; Paffenbarger, 1988; Sedgwick, Taplin, Davidson and Thomas, 1984). A recent meta-analysis by Crews and Landers (1987) shows that fit people respond to psychosocial stress in a hyporeactive way, however, the very few studies that used women as subjects suggest that the effect size for a hyporeactive response in fit women is half of that for fit men. In a critical review Van Doornen, De Geus and Orlebeke (1988) strongly question the prediction that fit people will be hyporeactive to stress on the basis of drawing an analogy between the responses to aerobic exercise and psychological stress. A psychological explanation might, therefore, well be considered. High physical fitness scores and aerobic exercise habits have been found to relate to lower anxiety, emotionality and depression (Doan and Sherman, 1987; Eysenck, Nias and Cox, 1982; Hughes, 1984).

The present paper, therefore, also seeks to find out if physical fitness is related to the personality traits and coping styles measured, and whether these relations show a different pattern for men and women.

Method

Subjects

Seventy seven subjects, 40 men and 37 women, participated in the study. They ranged in age from 23 to 32 years (mean age for the women was 24.8 and for the men 25.3 years). The subjects, measured in the previous two Chapters were included in the present subject group.

Procedure

As part of the procedure in the study on stress and coping in lecturing, student teachers completed questionnaires, measuring Type A behavior and the coping styles, and a physical fitness test at the beginning of a teacher training period. At the end of this period, some three months later, physical fitness was reassessed and the questionnaires measuring Type A behavior and the coping styles were completed again. On this occasion, several other questionnaires, measuring personality traits were completed as well. Fitness, Type A behavior, and the coping styles were measured twice as to ascertain the stability of these characteristics over a three month period.

Moderators

Physical fitness was determined by way of calculating the PWC170 ('Physical Work Capacity' at a heart rate of 170 bpm) on an electrically braked bicycle ergometer (Lode). This measure can be used to estimate the maximal aerobic capacity ($VO_{2\ max}$; Astrand and Rodahl, 1986). The protocol used is a 12-minute test, designed after the advice of the IBP (International Biological Program) and is described elsewhere (Verschuur, 1987).

Type A behavior was measured with the JAS which is validated for the Dutch population by Appels (1985).

Neuroticism and *Extraversion* were measured with the ABV (Amsterdamse Biografische Vragenlijst), a personality questionnaire which measures neuroticism and extraversion and also provides a lie score. This lie score may be interpreted as an attitude to respond to questionnaire items in a socially desirable way. The questionnaire is validated for the Dutch population by Wilde (1970).

Trait anxiety was measured with the Dutch version of the STAI (ZBV, Van der Ploeg, Defares and Spielberger, 1980). *Social anxiety* was measured with a questionnaire developed for the Dutch population by Willems, Teunder-De Haan and Defares (1973).

Coping styles were measured with a 47-item questionnaire, the Utrecht Coping List (UCL), developed for the Dutch population by Schreurs, Willige,

Tellegen and Brosschot (1988). This questionnaire is based on a coping questionnaire, developed and used by Westbrook (1979). The UCL consists of seven subscales, which measure attitudes to active problem solving, palliative responding, proneness to avoidance behavior, attitudes to seek social support, to show depressive responses, to express emotions (the items mainly refer to anger) and to have comforting cognitions. Cronbach's alpha for the seven subscales range from .57 to .89 and test-retest reliability scores, measured in several populations range from .51 to .85 (Schreurs et. al, 1988). Because the UCL was a newly developed questionnaire at the moment the present research started, and few psychometric data were available at that time, test-retest and internal consistency were determined in the present study.

Results

Stability in fitness, Type A behavior and the coping styles

The test-retest correlation for fitness is r= .92, and for Type A behavior it is r= .86. Test-retest correlations for the coping styles range from .55 to .85. The internal consistencies of the UCL subscales range from .46 to .85.

Sex differences in moderator scores

Descriptive information for the physical fitness and questionnaire scores is presented in Table 4.1. In order to establish whether there were any sex differences, Student t-tests were carried out.

There are only a few significant differences between men and women. As could be expected from the literature, men show a higher aerobic fitness compared to women (Astrand and Rodahl, 1986). Surprisingly no sex differences were observed for neuroticism and anxiety, although the social anxiety scores tend to be higher for women. In agreement with the literature women report that they seek more social support than men do. The women also report significantly more palliative responding as compared to the men.

Compared to standards, the subjects are close to the normal score, except on the lie-scale. On the lie-scale the mean score for the women falls within the lowest decile, the mean score of the men falls in the third decile. The subjects in the present study may, therefore, be considered very sincere in the way they completed the questionnaires.

Correlational analyses

The correlations among physical fitness and the personality characteristics, among Type A behavior and the coping styles and among physical fitness, personality characteristics, Type A behavior and the coping styles, for both men and women are shown in Tables 4.2, 4.3 and 4.4, respectively.

Table 4.1. Descriptive data for physical fitness, personality traits and coping styles for both sexes.

PWC170 = physical work capacity at a heart rate of 170 beats per minute
VO2max = maximal oxygen uptake in liters per minute; this index is estimated from the PWC170
N = neuroticism
E = extraversion
L = lie score
A = trait anxiety
SA = social anxiety
Type A = Type A behavior
APS = active problem solving
PR = palliative reponding
AV = avoidance behavior
SSS = social support seeking
DR = depressive responding
ER = emotional responding
CC = comforting cognitions

moderator	**men** n = 40		**women** n = 37		**significance**
	mean	sd	mean	sd	
fitness					
-PWC170 (Watt)	232.1	53.5	155.4	36. 6	$p < .000$
-$VO_{2\ max}$ (l/min)	3.6	.9	2.9	.5	$p < .000$
N	43.2	9.4	49.1	21.1	
E	56.6	15.0	57.1	15.0	
L	36.9	10.3	34.9	9.1	
A	35.4	7.0	35.3	6.7	
SA	36.1	10.2	41.2	12.6	$p = .056$
Type A [1]	13.1	4.4	13.9	4.6	
AP	21.9	2.8	21.4	3.34	
PR	16.8	2.8	18.8	2.46	$p < .001$
AV	16.8	2.9	17.8	3.5	
SSS	13.2	3.0	15.3	3.25	$p < .01$
DR	10.7	2.2	11.4	3.0	
ER	6.5	1.6	6.8	1.4	
CC	6.9	2.0	7.3	2.0	

[1] The JAS, used in the present study was not the most recent standardized version. Therefore, the total scores, presented in the Table are recalculated on the basis of the most recent JAS standards (Appels, 1985).

Table 4.2. Correlations among physical fitness and stable personality characteristics. For abbreviations, see Table 4.1

	men n= 40					
	1	2	3	4	5	6
women n=37						
1. fit		-.01	.18	.23	-.13	-.28*
2. N	-.21		-.15	-.13	.79***	.41**
3. E	-.04	-.10		-.23'	-.29*	-.52***
4. L	.17	-.20	-.39**		-.13	-.27*
5. A	-.10	.82***	-.21	-.11		.55***
6. SA	.28'	.34*	-.47**	.02	.42**	

' .05<p<.10; * p<.05; ** p< .01; **** p< .001

Table 4.3. Correlations among the coping styles and Type A behavior. For all abbreviations, see Table 4.1 and 4.2.

	men n= 40							
	1	2	3	4	5	6	7	8
women n=37								
1. APS		-.04	-.34*	.42**	-.21	.30*	.12	.04
2. PR	-.15		.41**	-.13.	.14	.01	.59***	-.14
3. AV	.04	.03		-.12	.18	.06	.36**	.04
4. SSS	-.15	.09	-.38**		.16	.22'	-.07	-.08
5. DR	-.35*	.09	-.30*	-.12		.20	-.07	.21
6. ER	-.25'	-.17	.14	.43**	.02		-.12	.59***
7. CC	.65***	.06	.04	.16	-.29*	-.23'		-.25'
8. Type A	.05	-.00	-.45**	.21	-.08	.22	.03	

Table 4.4. Correlations among physical fitness, personality characteristics, Type A behavior and coping styles. For all abbreviations see Table 4.1 and 4.2.

	APS	PR	AV	SSS	DR	ER	CC	Type A
				men n= 40				
fit	.15	.17	-.19	-.09	.18	.10	.03	-.02
N	-.45**	.20	.20	-.15	.56***	.12	-.03	.34*
E	.08	-.23'	-.19	.23'	-.20	.32*	-.25'	.15
L	-.00	-.16	-.21'	-.01	-.10	-.37**	-.09	-.15
A	-.52***	.10	.32*	-.19	.59***	.18	-.00	.27*
SA	-.23'	.10	.18	-.34*	.17	.05	-.02	-.27*
				women n= 37				
fit	-.07	02	.04	-.04	.09	-.29*	-.15	-.32'
N	-.25'	.12	.03	.00	.61***	.11	.09	.36*
E	-.04	.36*	-.48***	.43**	-.12	.40**	.32*	.29
L	.03	-.21	.17'	-.11	-.14	-.32*	-.35*	-.19
A	-.24'	.03	.02	-.01	.61***	.03	.13	.29*
SA	-.07	-.07	-.43**	-.06	.48***	-.42**	-.17	-.03

As can be seen from Table 4.2 the correlations among physical fitness and the personality characteristics for both men and women are rather similar. Physical fitness in men and women shows insignificant but consistent negative correlations with neuroticism and anxiety. In both sexes extraversion is negatively related to neuroticism and anxiety.

In contrast to Table 4.2, Table 4.3 shows a somewhat different pattern of correlations for men and women. Active problem solving is negatively related to depressive responding in both sexes but shows a strong positive relation with comforting cognitions only for women. For men, active problem solving does not relate to comforting cognitions but is negatively related with avoidance behavior and positively with seeking social support and expressing emotions. Comforting cognitions in men are strongly related to palliative responding and avoidance behavior. In women, palliative responding is not related to any other coping style and avoidance behavior is negatively related to seeking social support, depressive responding and Type A behavior. Type A behavior in men

is significantly related to expressing emotions. In both men and women expressing emotions is positively related to seeking social support but the relation is significant only for the women. Also, for both men and women comforting cognitions are negatively related to depressive responding but, here too, the relation is only significant for women.

In Table 4.4 the correlations among physical fitness, personality characteristics, Type A behavior and the coping styles are shown. The coping styles show some apparent differential relations with the stable personality characteristics for men and women. In women, physical fitness shows a significant negative relation with expressing emotions. For men, this relation is not significant and in the opposite direction. In women, extraversion is positively related to palliative responding, seeking social support and expressing emotions and negatively to avoidance behavior. In men, extraversion only shows a significant positive relation to expressing emotions. Anxiety in men is negatively related to active problem solving and positively to avoidance behavior, depressive responding and Type A behavior, whereas in women, only the relations with depressive responding and Type A behavior are significant. Social anxiety is negatively related to avoidance behavior and expressing emotions in women but not in men. Men only show a significant, negative relation between social anxiety and seeking social support.

Finally, a principal factor analysis (Varimax rotation) was performed for men and women separately. The results from the factor analyses are shown in Table 4.5. Although factor analysis provides a handy summary of the correlational analyses, it has to be considered with some caution. Given the number of variables that go into the factor analysis, the number of subjects in each analysis is somewhat small (Gorsuch (1983, in Zuckerman, et.al., 1988) recommended a minimum of five subjects per variable that goes into the factor analysis). In Table 4.5, only the factor loadings equal to or greater than .40 are shown.

For the women three factors, and for the men four factors were extracted which showed an eigenvalue greater than 1.0. The total variance, explained by the extracted factors is not very high. For both men and women it is less than 50 percent. This is probably due to the fact that several moderators, such as fitness and social support seeking, seem to be rather independent from the other characteristics and therefore do not contribute to common dimensions. For both sexes the first factor can be considered as a factor indicating anxiety or neuroticism and distress. All anxiety measures load high on this factor, together with depressive responding. For men but not for women, active problem solving shows a high negative loading on this factor. The second and third factor indicate the sex difference already discussed above. The women show a high loading of Type A behavior and extraversion, and a negative loading of avoidance behavior on the second factor. This factor for the women may best be described as an 'active, non-avoidance coping' dimension. The third factor extracted for the women consists of comforting cognitions and active problem solving. This coping dimension could therefore best be described as 'active but reflective coping' dimension. For the men, palliative responding and comforting cognitions load positively on the second factor. This coping dimension can therefore best be described as 'passive coping'. The third factor, extracted for the men, consists mainly of expressing emotions and Type A behavior. The lie scale loads negatively on this factor and active problem solving shows a positive loading. This factor may best be described as indicative of 'non-conformist' behavior.

Table 4.5. Factor loadings in a principal factor analysis (Varimax rotation) of the different moderators. Underneath the Table the eigenvalue (e.v.) and proportion of the total variance that is explained for each factor (% var) are given. For all abbreviations, see Table 4.1 and 4.2

moderator	women (n = 37)			men (n = 40)			
	factor			factor			
	I	II	III	I	II	III	IV
fit							
N	.89			.84			
E		.43					-.92
L						-.48	
A	.88			.83			
SA	.55			.42			.52
Type A		.65				.54	
APS			.72	-.52		.40	
Pal					.82		
Avoi		-.84					
SSS							
Dep	.72			.61			
Emot						.79	
CC			.88		.71		
e.v.	2.61	1.70	1.59	2.31	1.60	1.53	1.31
% var	18.7	12.1	11.4	16.5	11.4	10.9	9.4

The fourth factor for the men is indicative of the absence of (social) extraversion as it is almost entirely constituted by a negative loading of extraversion, together with a positive loading of social anxiety.

Discussion

The significant sex differences, found for several of the moderators are largely in accordance with the literature. It is generally found that the absolute values of physical fitness index scores are lower for women (Astrand and Rodahl, 1986). With respect to coping styles, the women report that they are more social support seeking, and use more palliative coping responses. The data of Pearlin and Schooler (1978) may be relevant in this respect as they reported that women were indeed more 'social support seeking' than men, and used more 'selective ignoring'. This latter coping behavior may be indicative of a passive avoidance, or palliative coping style. Although it may be expected from the literature that

women show higher neuroticism scores than men, the difference in neuroticism scores, albeit in the expected direction, does not reach significance in the present study. Moreover, the women show a tendency to report more social anxiety, which is a construct that is related to neuroticism.

As stated in the Introduction of this Chapter, it may be more useful to consider the coping patterns, found for both sexes, instead of just considering sex differences in reported frequency of using these coping responses. Of special interest is the finding that the sex differences in the correlational patterns are not found with respect to physical fitness and the personality characteristics but emerge when Type A behavior or the coping styles are considered. Type A behavior, and especially the coping styles do not only show sex differences when interrelated, but also when correlated with the stable characteristics. This finding may indicate that Type A behavior and the coping styles may differ in their role of moderator in stress-illness relationships for men and women.

As factor analysis is a handy summary of the many correlations that were calculated, the factor analyses will be used as a starting point in the present discussion. The first factor, extracted in both men and women, can be described as a general anxiety/neuroticism dimension. This dimension is associated with depressive responding in both men and women. For the men, but not for the women, this factor is negatively associated with active problem solving. Active problem solving may therefore be considered to relate negatively to maladaptive behavior in men but not necessarily in women.

Significant sex differences arise when the dimensions that are mainly constituted by coping styles are considered (factor II for the men and factor III for the women). Whereas a 'passive coping' dimension, constituted by positive loadings of palliative responding and comforting cognitions arises for the men, an active coping dimension, constituted by active problem solving and comforting cognitions, arises for the women. It has to be noticed that the factor loadings of comforting cognitions is high, both on the passive coping dimension for the men, and on the active coping dimension for the women. The correlational analyses give some further insight into the differential associations of comforting cognitions in men and women. Comforting cognitions in the women, for example, shows a significant negative correlation with depressive responding, whereas it shows a positive (although not significant) correlation with depressive responding in the men. Comforting cognitions shows a significant positive correlation with extraversion in the women, but this relation tends to be negative for the men.

The dimension, indicative of active coping behavior in the male subjects, (factor III) is constituted by positive loadings of Type A behavior, active problem solving and emotional responding. The correlations show, indeed, a highly significant positive correlation between Type A behavior and emotional responding. The emotional response coping style, as measured with the present questionnaire, is mainly constituted by items which are indicative of expressing anger. These results may therefore be interpreted to mean that anger is strongly associated with Type A in men but not in women. Hostility, a characteristic that is related to the expression of anger, is generally thought to be an aspect of Type A behavior. There is some evidence, indicating that hostility is more strongly related to CHD than Type A behavior itself (Matthews and Haynes, 1986). The correlations, found in the present study, suggest that this relation may be stronger for male Type A's than for female Type A's. Since the health-risk of Type A behavior is assumed to be mediated by cardiovascular hyperreactivity,

it is relevant to note that Harbin (1989) concluded, on the basis of a meta-analysis, that cardiovascular hyperreactivity was significant higher for the Type A as compared to Type B males, but this was not the case for the Type A females. It may therefore be concluded, in accordance with Hart (1988), that the present data indicate differential correlations between Type A behavior and the coping styles. The differential associations among Type A and the coping styles, as well as the differential relations of some of the coping styles to neuroticism, anxiety and extraversion, for men and women, support the suggestion that Type A and the coping styles play a different role as moderator in immediate- and long term stress effects in men and women. Differential coping patterns for men and women may, however, also explain why women, for example, are found to have more short-term health problems, while men have more long-term ones (Verbrugge, 1983).

A logical question, raised by these results, is whether the coping effectiveness of specific coping styles are found to differ for men and women. The best way to study coping effectiveness is a longitudinal design. Cronkite and Moos (1984) studied specific coping behaviors in relation to the longitudinal development of health indices in both men and women. The authors found avoidance behavior to be detrimental for 'later functioning' (operationalized as changes in 'depressed mood', ' physical symptoms' and 'alcohol consumption' over a one year period) in both men and women. In men, however, this behavior appeared to be primarily influenced by personal factors, whereas in women it was primarily influenced by environmental factors.

From Lazarus' theory and supported by evidence (e.g. Holahan and Moos, 1986; McCrae and Costa, 1986; McCranie and Brandsma, 1988; Parkes, 1986) it is suggested that coping which is related to direct coping actions such as active problem solving, rational action and perseverance is associated with well-being and fewer problems in the long run. On the other hand, coping that is related to suppression, avoidance behavior or withdrawal, palliative coping responses, sedation, passivity, indecisiveness and escapist fantasy are generally associated with maladaptive responses. The use and effectiveness of coping behaviors have, however, found to be dependent on the situation, especially with respect to the appraisal of the situation's amenability to change. Work contexts favor problem-focused coping and health-contexts (health problems) favor emotion-focused coping (Folkman, Lazarus, Dunkel-Schetter, DeLongis and Gruen, 1986).

Physical fitness, the only moderator that is not measured by way of a questionnaire, shows few relations with all other characteristics measured in the present study. Most of its correlations are only tendencies or are marginally significant. The low correlations between fitness and the other person characteristics, measured in the present study, should not, however, lead to the conclusion that physical fitness is insignificant as a moderator. The only conclusion to be drawn from the present data is that a possible stress moderating effect of fitness will be independent from that of the effects of the other characteristics for both men and women.

A final issue that is raised in the discussion of the present data concerns the stability of type A behavior and the coping styles, and their, sometimes quite high, correlations with the stable personality characteristics. Significant correla-

tions of Type A behavior and stable characteristics such as neuroticism, anxiety and extraversion are also found by Eysenck and Fulker (1983), and Furnham (1984). Recently, Van Heck and Vingerhoets (1989) reported significant correlations for coping styles, derived from the Ways of Coping Checklist and stable personality traits. In a study with monozygotic and dizygotic twins, Rahe, Hervic and Rosenman (1978) found that psychological tests which significantly correlated with the Type A behavior concept, such as dominance, impulsivity, exhibition, activity and aggression but also the A-B scale from the JAS questionnaire showed significant heritability estimates. Only Type A behavior, measured with the Structured Interview and some selected items from the Adjective Checklist (ACL) did not. In their review of the prospective value of Type A as a risk of CHD, Matthews and Haynes (1986), and more recently Matthews (1988) conclude that both the Structured Interview and the JAS have predictive value for CHD in groups which are not preselected on CHD risk. The correlations between these two Type A measures, however, are generally found to be low and it is therefore assumed that they measure different aspects of the coronary risk. In their "genetic analysis", using twin data, Eysenck and Fulker claim that heritability of the factors making up Type A behavior (i.e. tenseness, ambition and competition), exceeds 50%. The Swedish Adoption Twin Study of Aging (Pederson et. al., 1989) indicated that environmental influences were still very considerable for Type A-like measures and related traits. In this latter study, it was concluded that heritability explained 12 to 43 percent of the variance on the Framingham Type A scale, three descriptors of the Type A pattern (pressure, hard driving, and ambitious), and measures of hostility and lack of assertiveness. The heritability estimates for hostility and assertiveness (.20 and .12, respectively), were found to be insignificant. Approximately 60% of the variation in each of the measures could be attributed to environmental influences, unique to the individual. Bergman and Magnusson (1986) also reported a considerable stability of Type A behavior from childhood to adolescence, over a period of 14 years. They, however, found a differential stability for men and women. For men, stability of the Type A components Aggression and Overambition accounted for most of the prediction, whereas for women Motor Hyperreactivity did.

With respect to the coping styles it is assumed that these response attitudes as measured with a questionnaire, tap upon stable and to some degree heritable attributes as well. The present data, support the notion that the coping styles show stability across a three month period. The data, however, also suggest that the same characteristics may act differently as moderator in stress-illness relationships for men and women. The literature, discussed above, gives support to the notion of sex specific socialization processes in Type A behavior (and the coping styles) for men and women, despite a considerable stability of Type A (like) characteristics. When Type A or the coping styles show stability across time, this stability opens the possibility of characterizing possible differences in coping effectiveness between men and women with a comparable moderator profile. It is, however, essential to study the coping effectiveness of the stress moderators for both sexes in a longitudinal research design. This line of research is followed in the next Chapter, using a subgroup of the subjects measured in the present Chapter.

Chapter 5
MODERATORS AS PREDICTORS OF REACTIVITY TO AND COPING WITH THE STRESS OF LECTURING IN STUDENT TEACHERS

Summary

The aim of this study was to evaluate the moderating effect of several psychologically and biologically defined characteristics for both psychological and physiological indices of reactivity to and coping with lecturing stress. Student teachers were measured twice in a standardized lecturing situation: once at the start of a three month practice period and once at the end of this period. Reactivity was operationalized as an increase in heart rate, cortisol excretion and subjective anxiety responses in anticipation of and at the start of the lecture. Coping was operationalized as the attunement of these responses during, or recovery after lecturing (short term coping), and as the adaptation of these responses across the three month practice period (long term coping). It was found that reactivity to and (particularly long term) coping with the lecturing stressor could well be predicted by moderators such as physical fitness, extraversion, neuroticism, social anxiety and several coping styles. Specificity of predictor sets for sex and response parameters is discussed.

Introduction

In psychophysiological stress research, it is the underlying assumption that by measuring physiological, especially sympathetic reactivity to stressors, potentially pathogenic states can be detected (Krantz and Manuck, 1984). In the present Chapter, the predictive power of several biologically and psychologically defined moderators, which were described in the previous Chapter, will be determined for both physiological and psychological reactivity to and coping with an intrinsically motivating lecturing stressor.

To address the present research question, the measurements in the standardized lecturing situation are used. The reasons for this were that the responses to this lecturing stressor were valid and reliable, available for a large number of subjects, and unconfounded by class size.

The moderators to be studied are physical fitness, neuroticism, extraversion, social anxiety, Type A behavior and several coping styles. On the basis of the stress model by Lazarus and Folkman (1984) and on the basis of the literature addressed in the previous Chapter, it is hypothesized that these moderators will significantly relate to the responses to and coping with the stress of lecturing. As the moderators have been addressed separately in most of the literature, no predictions are made on the relative importance of these moderators for the responses to and coping with the stressor. Since it was shown in the previous Chapter that the moderators showed sex specific relations, and several studies showed important sex differences in the relation of these moderators to immediate or long term stress effects (e.g. Crews and Landers, 1987; Harbin, 1989; Hart, 1988), the moderator effects are evaluated for men and women separately.

Method

Subjects

Responses to the standardized lecturing stressor were available from 52 subjects (27 women and 25 men) (see also Chapter 2). The subjects ranged in age from 23 to 31 years (mean age for the women was 25.0, SD= 2.63 and for the men 25.3, SD= 2.12 years). Subjective anxiety data were available for all 52 subjects. Complete heart rate registrations, measured both at the beginning and the end of the teaching practice period were available for 39 subjects (17 men and 22 women). Cortisol was measured in 45 subjects (23 men and 22 women). The subjective anxiety and moderator scores for the subjects that were excluded from the analyses on the physiological data did not differ significantly from those of the remaining subjects.

Procedure

Before the measurements were started, subjects were familiarized with the apparatus to be used and the measurement procedure.

At the beginning and at the end of the teaching practice period, in which the subjects were to deliver real lectures at a post-secondary institution, the subjects delivered a standardized lecture of 30 minutes duration at the training institute. At this lecture, 6 fellow student teachers and 2 staff members of the training institute were present. Evidence for the validity of this standardized situation is presented in Chapter 2. This standardized lecture had to be prepared at home. Although subjects were not completely free to chose the subject of their lectures, they were free to determine the precise content of it.

During all the physiological measurements, an assistant was present to take care of all the activities necessary for measuring the responses.

Dependent measures

The measurement of *heart rate*, *cortisol* and *subjective anxiety* is described in Chapter 2. For heart rate, mean responses were calculated over three minute intervals for seven periods. Cortisol was determined in saliva samples, collected just before, and about 10 minutes after lecturing. Subjective anxiety was retrospectively determined with the anxiety thermometer. With respect to the subjective anxiety scores, only predictor sets for 6 moments will be determined, in Chapter 2 these moments are denoted as the moments 5 to 10 ('arrival at the Institution' to 'after lecturing'). The reason for this is that the other moments (except moment 1) did not appear to be stable across practice (Chapter 2), and had small scoring ranges, hereby reducing the potential to find significant correlational effects.

In the present study, *stress reactivity* is operationalized as an increase in heart rate, subjective anxiety and cortisol excretion in anticipation of, or at the start of the lecture. The *coping process*, as is to be measured in the present

study, will be evaluated both on a *short term* and on a *long term* basis. On a short term basis, the coping process is evaluated as the decrement in responses during lecturing and as the recovery of these responses after the lecture. To denote the change in responses across the lecture, when subjects are constantly attuning themselves to the (demands of) the situation, we will use the term *attunement*. Attunement is operationalized as the difference between the response measured at the start of and at the end of the lecture. The decrease in responses after lecturing will be denoted as *recovery*. For heart rate recovery, two recovery responses were determined. Recovery I is the difference between the response at the end of, and just after lecturing. Recovery II is the difference between the response just after, and about fifteen minutes after lecturing. For subjective anxiety, only one recovery is measured. Since the cortisol response was not significantly reduced after lecturing as compared to before (see Figure 2.3), no difference between the response measured before and after lecturing was calculated for cortisol. Additionally, attunement and recovery can not readily be discerned in the cortisol response, measured after lecturing because of its considerable latency. On a long term basis, the coping process is evaluated as the *adaptation* after repeated confrontation with lecturing across a three month practice period.

Moderators

The measurement of physical fitness, neuroticism, extraversion, social anxiety, Type A behavior and the coping styles was described in the Method Section of the previous Chapter.

Data analysis

For the physiological data, statistical tests were carried out on differences between the responses measured in the lecturing situation and the baseline. Baselines were obtained in a control session which took place on another day. Care was taken that the baseline measurements were performed at about the same time of day as when the responses during lecturing were measured. During this control session the subjects individually completed questionnaires for about 40 minutes.

Hierarchical multiple regression analyses were carried out to assess which characteristics best predicted the stress or coping response under consideration. In the hierarchical regression analyses on the difference scores that indicate attunement, recovery or adaptation, the response at the start of the lecture (for attunement), at the end or just after the lecture (for recovery I and II, respectively) and the responses at the first lecture (for adaptation) were forced to enter into the regressions as the first step.

An important issue that has to be reckoned with when studying reactivity indices and its predictors, pertains to whether physiological reactivity is correlated with baselines. The 'law of initial values' would predict that reactivity is less, when the baseline is high. When this is the case, reactivity may not only significantly be predicted by the baseline, but characteristics that are associated with the baseline may blur the prediction of reactivity itself. The correlations between baselines and physiological indices will therefore be inspected and

baseline will be entered in the regression in case it is systematically related to reactivity.

Results

The central topic of the present Chapter is the predictive value of several moderators for the reactivity in heart rate, cortisol and subjective anxiety to lecturing, the attunement of these responses during lecturing, the recovery after lecturing and the adaptation of these responses across the teaching practice period. The analyses in this Section will therefore primarily be concerned with the results from the multiple regression analyses, conducted on the dependent variables.

A graphical representation of the heart rate and cortisol responses, and of the subjective anxiety scores, measured at the beginning of and at the end of the practice period (first and second lecture, respectively) was already shown in Chapter 2 (Fig. 2.1 to 2.3).

The means and standard deviations, as well as the interrelations between the moderators for the subjects, measured in the present Chapter are comparable to those, reported in the previous Chapter. These data, measured in the subgroup of subjects from the present Chapter, can be inspected in Appendix III.

Heart rate reactivity and baseline appear to be completely unrelated. The cortisol responses, however, show some very significant correlations with the baseline, especially in the women. The cortisol baselines were, therefore, forced to enter in the first step of the regression analyses on the cortisol responses. When they add or tend to add significantly to the variance to be explained, they will be shown in the Tables [1].

Tables 5.1, 5.2 and 5.3 show the results from the multiple hierarchical regression analyses on reactivity in anticipation of, attunement to and recovery from the stress of lecturing in heart rate, cortisol and subjective anxiety, respectively.The Tables are composed of two parts, the upper part (A) shows the results of the regressions on the responses in the first lecture (at the beginning of practice), whereas the lower part (B) shows the results of the regressions on the responses at the second lecture (at the end of practice).

Heart rate *reactivity* (Table 5.1) for men is mainly predicted by fitness, whereas it is mainly predicted by extraversion for the women. The higher the fitness scores in the men and the more extravert the women, the lower is their heart rate response in anticipation to (I and II), and at the start of the lecture. Cortisol reactivity cannot very well be predicted, especially before practice (Table 5.2 A). After practice, coping styles show up as predictors of (anticipatory) reactivity, different ones for men and women. Reactivity of the subjective anxiety is higher for the men when they are high in neuroticism or social anxiety and for the women when they are high in social anxiety and low in extraversion.

[1] When cortisol baseline is entered as the first step in the regressions, one does not only correct for the relations between stress reactivity and baseline, but also for the characteristics which are associated to the baseline. The cortisol baseline was, however, unrelated to any of the moderators, measured in the present study.

Table 5.1 Predictors of the heart rate reactivity in anticipation of, and at the start of the first (A) and second (B) lecture, the attunement of the heart rate response during lecturing and the recovery of this response after lecturing, separately for men and women. The (+) or (-) behind the predictor denotes the direction of the relationship between the predictor and the heart rate response [2]

A	Heart rate responses			first lecture		
	men			women		
	predictor(s)	$F_{to\ enter}$	R^2_{cum}	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation I (15 min. before)	-			1. expressing emotions (+)	8.66**	.30
Anticipation II (just before)	1. fitness (-)	3.22'	.18	1. fitness (-) 2. extraversion (-)	3.78' 3.16'	.16 .28
Lecturing (start of)	1. neuroticism (-) 2. fitness (-)	3.53' 6.87*	.19 .47	1. extraversion (-)	3.85'	.16
Attunement	1. response at the start of the lecture (+)	13.70**	.48	1. depressive responding (-)	6.43*	.23
Recovery I (just after)	1. extraversion (-) 2. depressive responding (-)	5.72* 7.77*	.31 .57	1. response at the end of the lecture (+) 2. Type A (-)	7.09* 6.06*	.26 .44
Recovery II (15 min. after)	1. depressive responding (-)	5.27*	.24	1. response just after lecturing (+) 2. palliative responding (+)	22.26*** 5.60*	.53 .63

B	Heart rate responses second lecture					
	men			women		
	predictor(s)	F to enter	R^2_{cum}	predictor(s)	F to enter	R^2_{cum}
Anticipation I (15 min. before)	1. social support seeking (+) 2. fitness (-)	4.27* 9.00**	.24 .54	1. extraversion (-) 2. fitness (-)	5.18* 3.07*	.21 .32
Anticipation II (just before)	1. fitness (-) 2. neuroticism (-)	7.89* 11.43**	34 .64	1. extraversion (-)	12.76**	.39
Lecturing (start of)	1. fitness (-) 2. depressive responding (-)	11.66** 3.75'	.44 .56	1. extraversion (-)	8.84**	.31
Attunement	1. response at the start of the lecture (+) 2. expressing emotions (-)	19.87*** 3.18'	.57 .65	1. response at the start of the lecture (+) 2. neuroticism (-)	7.27* 6.15*	.27 .45
Recovery I (just after)	1. social anxiety (+)	4.01'	.19	1. response at the end of the lecture	27.56***	.58
Recovery II (15 min. after)	1. response just after lecturing (+) 2. depressive responding (+) 3. social anxiety (+)	4.03' 7.80* 10.53**	.21 .48 71	1. palliative responding (+)	8.21**	.28

' .05 p<.10; * p< .05; ** p< .01; *** p < .001

[2]Predictors are only reported when their contribution is significant (p < .05) or tends to be significant (.05 < p < .10).

Table 5.2 Predictors of the cortisol responses in anticipation of and after the first (A) and second (B) lecture, separately for men and women. The (+) or (-) behind the predictor denotes the direction of the relationship between the predictor and the cortisol response [2]. For abbreviations see Table 5.1.

A	Cortisol responses			first lecture		
	men			women		
	predictor(s)	$F_{to\ enter}$	R^2_{cum}	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation	-			1. baseline (-)	5.36*	.21
Attunement/ Recovery	1. social anxiety (-) 2. active problem solving (-)	3.56' 4.52'	.15 .30	1. neuroticism (+)	4.11'	.17

B	Cortisol responses			second lecture		
	men			women		
	predictor(s)	$F_{to\ enter}$	R^2_{cum}	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation	1. baseline (+) 2. palliative responding (+)	3.67' 4.81*	.15 .31	1. baseline (-) 2. Type A (-)	19.06*** 7.39*	.49 .63
Attunement/ Recovery	1. social support seeking (-)	3.80'	.16	1. baseline (-) 2. social anxiety (+) 3. Type A (-)	17.63*** 14.10*** 8.57'	.47 .69 .79

Table 5.3 Predictors of the subjective anxiety scores in anticipation of, and at the start of the first (A) and second (B) lecture, the attunement of subjective anxiety during lecturing and the recovery of this response after lecturing, separately for men and women. The (+) or (-) behind the predictor denotes the direction of the relationship between the predictor and subjective anxiety[2]. For abbreviations see Table 5.1.

A	Subjective anxiety			first lecture		
	men			women		
	predictor(s)	F to enter	R^2_{cum}	predictor(s)	F to enter	R^2_{cum}
Anticipation I (30 min. before)	1. social anxiety (+)	8.56**	.26	-		
Anticipation II (just before)	1. social anxiety (+)	10.67**	.31	1. extraversion (-)	4.91*	.16
	2. palliative responding (-)	.4.16'	41			
	3. neuroticism (+)	3.78'	.50			
Lecturing (start of)	1. neuroticism (+)	7.29*	.23	1. active problem solving (+)	9.31**	.27
	2. active problem solving (+)	10.44**	.47			
Attunement	1. avoidance behavior (-)	4.29*	.14	1. response at the start of the lecture (+)	9.95**	.28
	2. palliative responding (+)	3.39'	.24	2. palliative responding (+)	3.55'	.38
Recovery	1. response at the end of the lecture (+)	38.96***	.62	1. response at the end of the lecture (+)	4.71*	.16
	2. depressive responding (-)	4.68*	.68			

B	Subjective anxiety			second lecture		
	men			women		
	predictor(s)	F to enter	R^2_{cum}	predictor(s)	F to enter	R^2_{cum}
Anticipation I (30 min. before)	-			1. social anxiety (+)	7.92**	.24
Anticipation II (just before)	-			1. social anxiety (+)	10.58**	.30
Lecturing (start of)	1. neuroticism (+)	11.25**	.32	1. social anxiety (+)	4.39*	.15
	2. extraversion (-)	10.09**	.53	2. palliative responding (+)	3.27'	.25
Attunement	1. social support seeking (+)	7.27*	.23	1. response at the start of the lecture (+)	12.81***	.34
Recovery	1. response at the end of the lecture (+)	38.43***	.62	1. response at the end of the lecture (+)	22.50***	.47
	2. depressive responding (-)	5.82*	.69			
	3. Type A (-)	4.35*	.74			

For the men, the *attunement* of heart rate during lecturing, indicative of dealing with the stressor when it is still present, is positively associated with the response at the start of the lecture: the higher the heart rate responses at the start of the lecture, the greater the attunement. For the women, the attunement in heart rate is negatively associated with neuroticism or depressive responding (a coping style that was found to be highly correlated with neuroticism; Chapter 4) (Table 5.1). As the half life of cortisol in plasma is quite long, the cortisol response measured in the saliva collected after lecturing cannot distinguish attunement during lecturing from recovery after lecturing. Both the cortisol response, measured after lecturing, and the attunement in subjective anxiety are predicted by coping styles for the men (Tables 5.2 and 5.3). For the women, the cortisol response after lecturing is greater when the women are high in neuroticism and social anxiety. The attunement in subjective anxiety for the women is not well predicted.

Recovery of the heart rate response (Table 5.1) is smaller for the men when they are high in depressive responding or low in social anxiety. For the women, recovery of the heart rate response is predicted by several coping styles. The recovery in subjective anxiety (Table 5.3) is not very well predicted for the women but is negatively associated with depressive responding for the men.

It must be noted that the regression analyses on the coping responses which are most easy to obtain (i.e the attunement and recovery of the stress responses) are not very strongly predicted by the moderators, but appear to be strongly related to the initial responses, which were forced into the regressions as the first step.

Tables 5.4, 5.5 and 5.6 present the results from the hierarchical regression analyses, conducted on the differences between the responses, measured in the first (at the beginning of practice) and second lecture (after practice) for heart rate, cortisol and subjective anxiety, respectively. For heart rate and subjective anxiety, the responses at the middle of the lecture were left out of the Tables as they do not reveal additional information, here.

Adaptation of the heart rate response (Table 5.4) for the men is, again, predicted by fitness. The higher the fitness scores the greater the adaptation in heart rate. After the initial response and the fitness score, neuroticism comes into the regression on heart rate adaptation when anticipating the lecture. This adaptation is greater for those men who are high on neuroticism. For the women, extraversion is associated with greater heart rate adaption during anticipation and social anxiety is associated with a smaller heart rate adaptation at the start of the lecture. Social anxiety in women is also associated with less adaptation in cortisol and less adaptation in subjective anxiety (Tables 5.5 and 5.6). In the men, the coping styles are the main predictors of adaptation in cortisol, whereas neuroticism, extraversion and -to a lesser extent- the coping styles predict adaptation in subjective anxiety. Men who are high in neuroticism, low in extraversion and low in social support seeking behavior appear to show less adaptation in subjective anxiety.

Again, it must be noted that the initial responses explain a considerable amount of variance.

Table 5.4 Predictors of the adaptation in heart rate. The (+) or (-) behind a predictor denotes the direction of the relationship between the predictor and the adaptation in heart rate [2]. For abbreviations see Table 5.1.

	Adaptation in heart rate					
	men			women		
	predictor(s)	F to enter	R^2_{cum}	predictor(s)	F to enter	R^2_{cum}
Anticipation I (15 min. before)	1. response first lecture (+)	10.81**	.42	1. response first lecture (+)	18.91****	.49
	2. social support seeking (-)	10.79**	.67	2. extraversion (+)	3.98'	.57
	3. fitness (+)	6.09*	.78	3. social support seeking (+)	3.23'	.64
Anticipation II (just before)	1. response first lecture (+)	6.02*	.29	1. response first lecture (+)	18.27***	.48
	2. fitness (+)	3.60'	.43	2. extraversion (+)	.8.46**	64
	3. neuroticism (+)	6.62*	.62			
Lecturing I (start of)	1. response first lecture (+)	6.87*	.31	1. response first lecture (+)	7.23*	.27
	2. fitness (+)	6.54*	.53	2. social anxiety (-)	7.94*	.48
				3. Type A (+)	3.19'	.58
Lecturing II (end of)	1. response first lecture (+)	12.61**	.46	1. response first lecture (+)	11.56**	.37
	2. fitness (+)	4.65*	.59	2. expressing emotions (+)	4.31'	.48
Recovery I (just after)	1. response first lecture (+)	16.08***	.52	1. response first lecture (+)	23.03***	.54
				2. extraversion (+)	4.63*	.63
Recovery II (15 min. after)	1. response first lecture (+)	18.95***	.56	1. response first lecture (+)	3.61'	.15
	2. social anxiety (+)	9.15**	.73			
	3. depressive responding (+)	4.02'	.80			

Table 5.5 Predictors of the adaptation in cortisol. The (+) or (-) behind a predictor denotes the direction of the relationship between the predictor and the adaptation in cortisol [2]. For abbreviations see Table 5.1.

	Adaptation in cortisol responses					
	men			**women**		
	predictor(s)	$F_{to\ enter}$	R^2_{cum}	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation	1. response first lecture (+)	51.34***	.71	1. response first lecture (+)	76.95***	.79
	2. palliative responding (-)	5.57**	.77			
	3. social anxiety (-)	3.00'	.80			
Attunement/ Recovery	1. response first lecture (+)	17.48***	.45	1. response first lecture (+)	23.34	.54
	2. social support seeking (+)	4.00'	.54	2. social anxiety (-)	6.19	.65

Table 5.6 Predictors of the adaptation in subjective anxiety. The (+) or (-) behind a predictor denotes the direction of the relationship between the predictor and the adaptation in subjective anxiety [2]. For abbreviations see Table 5.1.

	Adaptation in subjective anxiety					
	men			women		
	predictor(s)	$F_{to\ enter}$	R^2_{cum}	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation I (30 min. before)	1. response first lecture (+)	30.41***	.56	1. response first lecture (+)	31.63***	.53
				2. social anxiety (-)	6.57*	.61
Anticipation II (just before)	1. response first lecture (+)	36.87***	.61	1. response first lecture (+)	9.79**	.27
				2. social anxiety (-)	7.24*	.44
Lecturing I (start of)	1. response first lecture (+)	17.49***	.42	1. response first lecture (+)	12.31**	.32
	2. neuroticism (-)	10.17**	.60	2. social anxiety (-)	3.56'	.41
	3. extraversion (+)	9.40**	.72			
Lecturing II (end of)	1. response first lecture (+)	33.52***	.58	1. response first lecture (+)	21.65***	.45
	2. social anxiety (-)	8.41**	.69	2. social anxiety (-)	3.21'	.51
	3. social support seeking (+)	4.34*	.74			
Recovery	1. response first lecture (+)	9.20**	.28	1. response first lecture (+)	60.86***	.70
	2. extraversion (+)	4.40*	.39			

Discussion

The results of the present study indicate that reactivity to and coping with an intrinsically motivating stressor such as lecturing can, to a considerable degree, be explained by the moderators as measured in the present study. Despite the overall reduction in the stress responses across practice, a greater amount of variance, especially in the physiological responses, was predicted after practice. In this study, in fact four types of responses were predicted: reactivity to the stressor, attunement when dealing with the stressor for 30 minutes, recovery from the stressor and adaptation to the stressor across a three month practice period. The results indicate that the predictor sets differ with respect to the type of response that is predicted (reactivity, attunement, recovery or adaptation), the response parameter that is studied and appears to be sex specific.

In this discussion, first the moderators that appeared as significant predictors of the reactivity and coping responses will be discussed one by one. Next, attention will be given to the differences in the predictor sets for the three dependent measures.

The finding that physical fitness showed up as an important predictor of heart rate reactivity only for the men is in accordance with the results from the meta-analysis by Crews and Landers (1987). These authors found fit subjects to be hyporeactive to psychosocial stressors but the effect size for the women was half of that for the men. As only four of the twenty studies in this meta-analysis used women as subjects, the evidence on stress reactivity in women is not very strong. It may be argued that the somewhat smaller range in PWC170 values for women (see Chapter 4) may have reduced its predictive power in the present study. After Z-transformation of both predictor and dependent variables, for men and women separately, the regressions, however, resulted in the same predictor sets for heart rate as those reported in the present Results Section.

A sex difference is also apparent in epidemiological studies on the protective value of physical fitness or physical activity. It must, however, be noted that the data on women in this research area are scarce as well. Powell et. al. (1987), reviewed 43 studies on the relationship between physical activity and coronary heart disease. Only five studies presented data on women separately. On the basis of this review, it can be concluded that the evidence for an inverse relation between physical activity and determinants of coronary risk was weak to absent for the women, whereas it was found to be moderate to strong for the men. The findings of Kannel, Wilson and Blair (1985) illustrate the conclusions from the above review as they found the prospective epidemiologic data from the "Framingham study" to indicate that overall mortality, cardiovascular mortality and coronary mortality were all inversely related to the level of habitual physical activity. For the men, but not for the women, the effect persisted when other risk factors were taken into account.

It is suggested that fitness may moderate the physiological stress response, and for that reason lowers CHD-risk. In a critical review, Van Doornen, De Geus and Orlebeke (1988) strongly question this suggestion, not only because of the lack of consistent findings in the literature concerning fitness and stress reactivity (a considerable amount of studies do not find an effect, and the effects are not consistently found for the same responses). They also question the basis of this prediction because of the differences in regulatory mechanisms under-

lying the responses to physical as opposed to psychosocial stressors. Also, training studies that specifically studied (aerobic) training effects on the physiological response to psychosocial stressors have produced quite inconsistent data and most stress responses were not found to show training effects despite increases in aerobic fitness (e.g. Cleroux, Peronnet and De Champlain, 1985; De Geus, Van Doornen, De Visser and Orlebeke, 1990; Seraganian et. al. 1987; Sinyor et.al., 1986).

Van Doornen et. al (1988), among other things, suggest that a more psychosocial explanation might apply to the hyporeactive response to stress in fit men. Physically fit men are, psychologically, a different type of persons. Physical fitness is consistently found to be positively, although not very strongly, associated with an extraverted temperament and negatively with neuroticism and anxiety (Eysenck et. al., 1982). Also, physical fitness is associated with self-confidence, high self-esteem and a positive self-concept (Doan and Sherman, 1987; Hughes, 1984). In this study, extraversion, neuroticism and anxiety have been measured. As has been shown in the previous Chapter, physical fitness was not significantly associated with any of these characteristics in the student teachers. On the basis of our research data the suggestion of such a psychosocial explanation by Van Doornen et. al. is not readily supported, although a possible moderating role of self-esteem, self-confidence, self-concept or other fitness related characteristics can not be ruled out.

Extraversion systematically showed up as an important predictor of the heart rate response in women when anticipating and beginning the lecture. These results are largely in accordance with the predictions of Eysenck's personality theory (Eysenck, 1967). Several experiments showed that extraverts had lower heart rate responses and experienced lower arousal to demanding tasks (e.g. Geen, 1984; Hinton and Craske, 1977). Extravert women also report less subjective anxiety when anticipating the lecture before practice but this relation disappears at the end of practice. In the male subjects, extraversion is only negatively related to the subjective anxiety reported at the start of lecturing after practice. The reason why extraversion appears to be an important predictor of physiological reactivity in women and not in men is unclear.

Neuroticism also showed up as a significant predictor several times and appeared to be associated with a hyporeactive heart rate response at the anticipation of, or at the start of the lecture but also with a higher cortisol response after lecturing and a smaller decrease in heart rate. There is some experimental support for these findings. Burdick, Van Dijck and Von Bargen (1982) and Forsman (1980) also reported a physiological hyporeactivity in neurotic subjects whereas Bull and Nethercott (1972) reported an inverse relation between neuroticism and physiological recovery. Despite their hyporeactive heart rate response, the male subjects that were high in neuroticism reported high subjective anxiety scores at the start of lecturing. Costa and McCrae (1987) elaborate on the fact that although neuroticism appears to be related to health complaints, it has not shown to be related to mortality risk. The results of the present study indicating an association between neuroticism and self-reported anxiety may well predict future health complaints. The associations between neuroticism (and depressive responding) with the physiological responses are, however, ambiguous: according to the hyperreactivity or sustained activation hypotheses (Krantz and Manuck, 1984; Ursin, 1980), a hyperreactive

response is thought to mark, or may even induce and promote pathology, whereas less attunement, a delayed recovery or less adaptation are thought to additionally promote or exacerbate pathological processes.

For the women, it is not neuroticism but social anxiety that is predictive of both subjective anxiety at the start of lecturing and the objectively measured cortisol responses.

Type A behavior did not systematically emerge as a significant predictor of stress reactivity or coping, except that it was negatively associated with the cortisol response in the women, suggesting that Type A behavior is associated with less distress. The coping styles appeared to be especially associated with the cortisol response. On the basis of Lazarus' theory and supported by evidence (e.g. McCrae and Costa, 1986; Parkes, 1986) it is suggested that coping that is related to direct coping actions is associated with well-being and fewer problems in the long run. On the other hand coping that is related to suppression, avoidance behavior or withdrawal is associated with maladaptive responses. The use and effectiveness of coping behaviors has, however, found to be dependent on the appraisal of the situation's amenability to change. When this amenability is high, active problem solving is favored, whereas emotion-focused coping is favored when it is low (Folkman, Lazarus, Dunkel-Schetter, DeLongis and Gruen, 1986; Pearlin and Schooler, 1978). The results of the present study, which focuses on stress and coping in a lecturing situation that cannot beforehand be considered non-amenable, is consonant with these general findings: the cortisol response was negatively associated with Type A behavior, active problem solving and with social support seeking behavior, whereas it was positively associated with palliative responding, depressive responding, neuroticism and anxiety. A greater adaptation in cortisol was associated with less palliative responding and more social support seeking in men.

Incidentally, the coping styles also predicted the heart rate responses. Depressive responding most frequently occurred as a negative contributor in the equations. As depressive responding and neuroticism are highly associated it might be expected that they are comparably associated with the dependent variables.

Subjective anxiety is, to a certain extent, also predicted by the coping styles. The coping styles that are significantly associated with subjective anxiety before practice, however, disappear as significant predictors later on. Before practice the set of coping styles that predicts subjective anxiety is very similar for men and women: palliative responding is associated with a greater decrease in subjective anxiety during the first lecture in both men and women, but is also associated with a smaller cortisol adaptation, especially in the men. This might be interpreted as that palliative responding may be beneficial on the short term but not on the longer term.

Social support seeking consistently contributes as a predictor for the males. The more they seek social support, the greater their decrease in subjective anxiety and their cortisol adaptation. It is noticeable that those men who report to seek social support show a better adaptation to the stress of lecturing than the men who do not. Although this coping style is significantly less frequently used by the men compared to the women it does not emerge as predictor in the regressions for the women (see also the previous Chapter).

It was found that of the three dependent variables, heart rate could be most consistently predicted. The most significant predictors for heart rate did not emerge as predictors for the two other variables. The fact that rather different predictor sets were found for the different dependent variables is not very surprising. The relative independence between heart rate and cortisol may partly be related to their different physiological regulatory mechanisms. Heart rate is regulated by both nervous and hormonal factors and can respond very quickly to a stimulus. Cortisol has a much longer latency and is under the influence of negative feedback from hypothalamic areas and from the hypophysis.

As stated in Chapter 3, a heightened increase in heart rate is not necessarily associated with negative stress effects but can also be induced by motivational incentives and active coping (e.g. Fowles, 1983; Obrist et. al., 1978). Especially sustained heart rate activation must be considered maladaptive. Activation of the pituitary-adrenal-cortical axis is associated with defensiveness and poor performance (e.g. Baade et. al., 1978) and has also been related to suppression of immunologic parameters (e.g. Rogers, Dubey and Reich 1979; Sklar and Anisman, 1981). Cortisol may also induce high cholesterol levels and is associated with atherosclerosis (Troxler and Schwertner, 1985).

As far as physiological hyperreactivity is pathogenic, only longitudinal research can provide insight into the relation between (physiological) reactivity, its associated moderators, stress and illness. For heart rate reactivity and -to a lesser extent- cortisol reactivity it must be noted that the predictive power of relatively stable characteristics was found to be greater after practice with the intrinsically motivating stressor. The more intimate relation between the moderators and physiological reactivity when subjects become more experienced with the real stressor, might indicate that the moderators itself become more strongly related to, or indicative of illness when one gains experience in the stressful situation.

Summarizing the present findings, it may be concluded that:

- the reactivity to and (especially the longer term) coping with an intrinsically motivating stressor can, to a considerable degree, be predicted by physical fitness, extraversion, neuroticism, social anxiety and several coping styles;
- the predictive power of these moderators appears to be greater after a practice period that gave the subjects the opportunity to learn to cope with the stressor;
- short term (attunement and recovery) and long term coping (adaptation) are, to a considerable degree, predicted by the initial responses. The predictor sets that emerged from the regressions on the long term coping responses were, however, more consistent than those that emerged from the regressions on the short term coping responses;
- profound sex differences exist in the predictor sets for reactivity and coping. This might be interpreted as that specific personal characteristics have a different moderating potential for men and women;
- the different stress indices are predicted by different (combinations of) predictor sets.

Chapter 6
MODERATORS AS PREDICTORS OF REACTIVITY TO A LECTURING STRESSOR AND OF HEALTH (RISK) INDICES IN EXPERIENCED, MALE TEACHERS

Summary

The relative importance of physical fitness, physical activity, personality characteristics and coping styles as predictors of psychological and physiological responses to a real life lecturing stressor was determined, as well as the relative importance of these moderators for predicting resting blood pressure, resting blood lipids, and subjective well-being. Subjects were experienced, male teachers, appointed at a post-secondary institution. Heart rate responses, cortisol excretion and subjective anxiety were measured as stress indices.

The results indicated that the heart rate responses to the lecturing stressor were only marginally related to the moderators, but not those that emerged as significant predictors of heart rate in the male student teachers. The coping styles were somewhat predictive of the cortisol responses. Extraversion was consistently related to hyporeactive subjective anxiety scores. Responses to the lecturing stressor were unrelated to resting blood pressures and blood lipids, except for the cortisol response which was significantly related to the triglyceride level. Active coping styles, especially avoidance behavior, were found to be related to an increased CHD risk, whereas passive coping (palliative responding) was related to a reduced CHD risk. Subjective well-being appeared to show strong negative relations to neuroticism, depressive responding, Type A behavior, and a positive relation to self-esteem.

Introduction

In the present Chapter, the focus of the research will be directed to the stress of lecturing in experienced teachers. As was already mentioned in the Introduction of this thesis, teaching is experienced as rather stressful, also by experienced teachers, and found to be associated with health complaints and burnout (e.g. Innes & Kitto, 1989; Kyriacou, 1987; Mykletun, 1984). In addition to the stress ratings, personality characteristics like neuroticism were repeatedly found to be associated with self-reported psychological and physical health symptoms and with immunological functioning in teachers as well (Innes and Kitto, 1984; Ursin et. al., 1984, respectively).

In the present thesis, the underlying assumption was that exaggerated physiological responses to challenging, and intrinsically motivating stimuli would be mark or mediate pathological processes. The accent of the research thus far, has been on establishing the stability of the responses to lecturing in student teachers across a period of practice, and on the predictive power of several moderators for reactivity to and coping with the stress of lecturing. Stability in heart rate, cortisol, and subjective anxiety responses appeared considerable. In the previous Chapter, it was shown that the psychological and physiological indices for reactivity, to and also coping with the stress of lecturing could be predicted by relatively stable characteristics and coping styles. Especially for the physiological indices, the predictive power of these moderators appeared

higher at the end of, as compared to the beginning of a period of teaching practice. Physical fitness and neuroticism were found to predict heart rate reactivity and heart rate adaptation to the lecturing stressor in the males, whereas extraversion predicted this in the females. The cortisol responses appeared to be predicted by several coping styles. Subjective anxiety was predicted by neuroticism, social anxiety, extraversion and the coping styles in the male and female student teachers.

The above findings raise some interesting questions concerning the predictive power of these moderators for reactivity to and coping with the stress of lecturing, especially when the student teachers enter the teaching profession and have a further growing experience in coping with the lecturing stressor. It may be hypothesized that the moderators may become even more intimately related to health risk. The hypothesis that aforementioned moderators do predict which persons will successfully adapt to the teaching profession can, however, only be properly tested in a longitudinal study. As such a study could not be carried out within the time scope of the present research project, a pilot study was undertaken to determine the relationships between the moderators and reactivity to and (short term) coping with the stress of lecturing in the experienced teachers who supervised the student teachers. It was hypothesized that such a study would provide a first impression of what might be expected from a follow-up study of the student teachers.

The present study with the experienced teachers can be considered a pilot study, and will, therefore, not be confined to determining the relative importance of the moderators in their relation to the psychological and physiological responses to the lecturing stressor. The relative importance of the moderators will also be determined for several objective health-risk indices and for several indices of subjective well-being. As has been found in the studies, available on experienced teachers, the moderating individual characteristics are also related to objective health risks and to indices of subjective well-being.

In the previous Chapter, fitness emerged as a strong predictor of heart rate reactivity and heart rate adaptation. From the literature, it is known that fitness is also associated with lower cholesterol levels, and that aerobic training is associated with an increase in HDL-cholesterol levels and a decrease in total, VLDL- and LDL cholesterol levels (e.g. Tran, Weltman, Glass and Mood, 1983). On the other hand, fitness and aerobic training effects have also found to be associated with low depression scores (Bosscher, 1985; Doan and Sherman, 1987) and increased mental well-being (e.g. Moses, Steptoe, Mathews and Edwards, 1989). The positive effect of aerobic training in this latter study was not found to be mediated by an increase in aerobic power. Type A behavior has found to be significantly related to physiological reactivity (e.g. Harbin, 1989). Type A behavior, or several of its aspects, have also found to be predictive of total cholesterol, or its subfractions (Lundberg, Hedman, Melin and Frankenhaeuser, 1989; Van Doornen and Van Blokland, 1987). Anger and hostility (subcomponents of Type A behavior), neuroticism and anxiety have often found to be associated with self-reported illness (Costa and McCrae, 1987; Watson and Pennebaker, 1989), and with an objective health risk (Friedman and Booth-Kewley, 1987).

These studies suggest that the same moderator may predict different health-risks. In the studies on monkeys by Manuck and coworkers (1983, 1989), however, the relationship between heart rate reactivity and degree of atheros-

clerosis was found to be independent from other indices of coronary heart disease (CHD) risk like cholesterol and blood pressure levels. In humans, hyporeactive physiological responses, and a greater recovery from stressors was found to buffer the effects of hassles on subjective well-being (Gannon et. al, 1989). Increases in cortisol may both directly and indirectly increase CHD-risk (Troxler and Schwertner, 1985). The present pilot study, therefore, intends to study the interdependence of the reactivity to the lecturing stressor and several health(-risk) indices, and to see if the moderators that were measured in the previous Chapter, additionally or differentially predict different indices of objective health-risk and subjective well-being in the same persons.

The moderators to be measured in the present study are the same as those that were measured in the previous study on student teachers, i.e. physical fitness, neuroticism, extraversion, social anxiety, Type A behavior and several coping styles. In addition to these, some other moderators are also measured. As suggested by the training study of Moses et. al. (1989), and by Van Doornen et. al. (1988), instead of the aerobic power aspect of fitness, fitness related characteristics may be responsible for the protective value of physical fitness, or aerobic training. Aerobic power is often confounded with an active lifestyle that induces a habitually high energy expenditure. Habitual physical activity will therefore be measured as well. Self-esteem will also be measured as this characteristic is often found to be associated with physical fitness and physical activity (e.g. Doan & Sherman, 1987; Hughes, 1984; Sonstroem, 1984) and has found to be a significant moderator in stress-illness relationships (Cronkite & Moos, 1984; Holahan and Moos, 1986; Pearlin and Schooler, 1978). As pronounced sex differences were found in the study on student teachers, especially with respect to the prediction of heart rate reactivity and adaptation, only males were chosen as subjects in the present study.

To summarize, the aims of the present pilot study are firstly, to determine the relative importance of the moderators as predictors of psychological and physiological responses to the stress of lecturing in experienced teachers. Secondly, the interrelations between the responses to the stress of lecturing, resting blood pressures, resting blood lipid levels, and indices of subjective well-being will be determined, as well as the relative importance of the moderators as predictors of these objective CHD-risk indices and for the indices of subjective well-being. It is hypothesized that fitness and fitness related characteristics, neuroticism, extraversion, social anxiety, Type A behavior and the coping styles, are related to health(-risk) indices. Since most studies did not measure more than one moderator at the same time, no predictions are made with respect to their relative importance as predictors. An exception is made for the relative importance of the moderators in predicting the lecturing responses, as it is hypothesized the findings reported in Chapter 5 for the male student teachers, will be replicated.

Method

Subjects

Nineteen experienced teachers participated in this study. The teachers ranged in age from 30 to 44 years (mean age was 37.5, SD= 3.6). They were all appointed as teacher at a post-secondary institution, and taught subjects like physiology, anatomy, psychology and theoretics in physiotherapy or nursing. Their teaching experience was 10.5 years (SD= 3.5). They worked 34.8 (SD= 7.6) hours per week as a teacher. About half of them had been supervisors of the student teachers, measured in the previous study, the others were colleagues who also volunteered to participate.

Responses to lecturing

Heart rate, cortisol, and *subjective anxiety* responses will be measured as described in Chapter 2. Heart rate responses were calculated over 3 minute intervals for seven periods. Cortisol will be determined in saliva samples, taken just before, and some ten minutes after lecturing. Subjective anxiety was measured with the anxiety thermometer. As in the previous Chapter, subjective anxiety was assessed for 6 moments: the moment of arrival at the Institution, just before, at the start of, at the middle of, at the end of, and after the lecture (note that these moments correspond to the moments 5 to 10, as measured in Chapter 2).

Stress reactivity will be operationalized as an increase in heart rate and subjective anxiety at the anticipation of, and at the start of the lecture. As in the previous Chapter, two anticipatory responses will be determined for heart rate and subjective anxiety (anticipation I and II). For cortisol, only one anticipatory response will be determined. The coping process will be evaluated on a short term basis, i.e. as the *attunement* of the responses during lecturing and as the *recovery* of these responses after lecturing. In the following text these coping responses will be denoted as attunement and as recovery, respectively. As in the previous Chapter, heart rate recovery will be determined just after, and about fifteen minutes after the lecture (recovery I and II). Due to its considerable latency, attunement to, and recovery from the stress of lecturing cannot clearly be discerned from one another in the cortisol response.

Moderators

Physical fitness was operationalized as the *PWC150* ('Physical Work Capacity' at a heart rate of 150 bpm) and as the *maximal O_2 uptake* (ml/kg.min). Since the present subject population is older than that measured in the previous Chapter, and their maximal heart rate may be expected to be about 170 bpm (e.g. Houtman and Schlatmann, 1988), it is more appropriate to measure work capacity at a heart rate of 150 bpm, instead of 170 bpm. PWC150 is an indicator of the efficiency of the heart to deal with a physical load, and is associated with aerobic fitness. Measurement of the maximal O_2 uptake, however, is considered the best index of the individual's aerobic power (Astrand and Rodahl, 1986).

Both indices were measured in the same exercise test, performed on an electrically braked bicycle ergometer (Lode). Pedalling rate was kept between 60 and 70 revolutions per minute. It was the same as in the previous Chapters (4, 5), except for the last three minutes. The exercise procedure consisted of four exercise blocks of three minutes each, with increasing workload in each block. In the fourth exercise block, the subject was set at a workload that corresponded to 120 percent of his estimated maximal O_2 uptake, predicted from the Astrand-nomogram (Astrand and Rodahl, 1986) on the basis of the heart rate and workload that were measured at the end of the third exercise block. Heart rate was continuously measured during the exercise test with a cardiotachometer (Rood Electronics, type 106A) and was printed every 30 seconds. After the sixth minute of the exercise test the subject put in a mouthpiece and the expired air was continuously collected and analyzed by an O_2 and CO_2 analyzer (Jaeger) and expired volume was determined with a flow meter (Jaeger screenmate).

PWC150 was calculated from the individual regression lines between the heart rates and workloads at the end of the first three exercise blocks. The fourth exercise block was stopped when the subject either gave up, or was ended after the 12th minute when either the maximal O_2 uptake leveled off, or showed a trend to decrease, and the respiratory quotient (RQ) was more than 1.1. When the intermediate output of RQ and O_2 uptake suggested that these criteria would probably not be met, the workload was increased during this final exercise block. The maximal O_2 uptake was the highest O_2 uptake as measured in the fourth exercise block, calculated on the basis of the expiratory volume and the O_2- and CO_2-content of the expired air at the supramaximal load. *Habitual physical activity* (HPA) was measured with a questionnaire, based on Taylor et. al. (1978). The subject was asked to check the activities he had been engaged in for the last six months, and to report these for each month separately. If he had performed a particular activity he was asked to report the time he spent doing that activity that month in minutes per week. After completing the questionnaire, the subject was interviewed and was asked to assign the activity to one of four intensity classes, according to a classification by Verschuur (1987): very light, light, medium-heavy or heavy. They could use a card with examples of activities from these classes. A sumscore was computed that reflected an estimate of the (habitual) energy expenditure per week for the last 6 months by multiplying the time spent per level of intensity with a fixed value, indicative for the basal metabolic rate (MET) held to be representative of that level (2.0, 5.5, 8.5 and 11.5 respectively, according to Verschuur, 1987).

Self-esteem is measured with the Rosenberg Self-Esteem Scale (RSES), translated for the Dutch population by Helbing (1982). Reliability and validity data for the Dutch version are provided by Baardman (1989), Bakker (1988), and Helbing (1982).

Type A behavior was measured with the JAS, which is validated for the Dutch population by Appels (1985).

Neuroticism, extraversion, social anxiety and the *coping styles* were measured as described in the Method Section of Chapter 4.

CHD risk indices [1]

Resting blood pressures were measured on a control day, at the end of a questionnaire session that lasted for about 1 hour. Spacelab and OMRON (model HEM-700C) automatic blood pressure monitors were used. Due to an apparatus failure, the resting blood pressures of one of the subjects could not be measured.

Total cholesterol, HDL- cholesterol and *triglycerides* were determined in blood plasma [2]. Subjects were asked to refrain from eating and drinking (except water) until the blood sample was taken. After fasting for about 12 hours, the triglyceride concentration is indicative of the VLDL-cholesterol fraction. *LDL-cholesterol* was calculated according to Friedewald [3].

Indices for subjective well-being

Depression was assessed with the Dutch translation of the Self-Rating Depression Scale (SRDS; Zung, 1965). Reliability and validity of the Dutch SRDS is reported by Dijkstra (1974).

Psychological and *somatic health symptoms* were measured with the Dutch version of the Hopkins Symptom Checklist (HSCL; Luteijn, Hamel, Bouwman & Kok, 1984).

Procedure

The experienced teachers were measured on two, arbitrarily chosen, working days. The first measurement served to get the subjects acquainted with the apparatus and measurement procedure. For two of the teachers the second heart rate registration failed and they were measured on a third working day. When the first heart rate registration failed, no third measurement took place. Only the data from the last measurement were used in the data analysis. For all subjects the measurements were carried out before, during and after their first lecture at the day of the measurement session. All but two subjects lectured early in the morning.

Baselines for heart rate, cortisol and resting blood pressure were taken during a standardized control session on a separate day. Heart rate was measured during a 1 hour period in which the subjects sat quietly and completed question-

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[1] Smoking behavior and family history of hypertension or CHD are also health risks, which could be easily determined. The present subjects were therefore also asked about this. Since, however, the subjects who smoked, and the subjects who had a family history of either hypertension or CHD did not differ in reactivity to, or coping with the stress of lecturing, nor in any of the moderators or health (-risk) indices no attention is paid to these risks in the main text of the present Chapter.

[2] The blood analyses for cholesterol and its subfractions were performed by the laboratory of the Free University Academic Hospital, Amsterdam

[3] LDL-cholesterol was calculated according to Friedewald (Stalenhoef, 1987):
LDL (mmol/l) = total cholesterol - HDL - triglycerides * 0.45

naires. The procedure of the control session was the same as described for the student teachers in Chapter 2. The saliva samples and resting blood pressure levels were taken at the end of the questionnaire hour. Care was taken that the measurements during the control session took place at about the same time of day as when the responses were measured in the lecturing situation. After completing the questionnaires, subjects were taken to the outpatients' clinic of the Free University Academic Hospital where bloodsamples were taken to determine total cholesterol, HDL-cholesterol and triglycerides. After the blood sampling, subjects were offered a light meal, and the HPA-interview was performed. The control session ended with the fitness test.

Data analysis

Physiological reactivity is defined as the difference between the absolute response level, measured in anticipation of, or at the start of the lecture, and the individual baseline. Attunement is defined as the difference between the response at the start and the response at the end of the lecture. Heart rate recovery I and II are defined as the difference between the heart rate response at the end of or just after the lecture, and the response just after or fifteen minutes after the lecture, respectively. For cortisol, the same strategy is followed as with the student teachers for whom separate regressions were conducted on the cortisol responses before and after lecturing.

Hierarchical multiple regression analyses were carried out to assess which individual characteristic or set of characteristics best predicted reactivity, attunement, recovery or the other health (-risk) indices. When the regression analyses concerned attunement or recovery, the response at the start of, at the end of or just after lecturing was forced to enter in the first step, respectively. Before conducting the regression analyses, repeated measures ANOVA's or Student t-tests for paired observations were performed on the difference scores (stress levels minus baseline) to determine changes in heart rate, cortisol and subjective anxiety, measured before, during and after lecturing. The Newman-Keuls test was used for post-hoc testing.

As was mentioned in the previous Chapter, an important issue that has to be reckoned with when studying reactivity indices and its predictors, pertains to whether physiological reactivity is correlated with baselines. In this study, too, the correlations between the baselines and physiological reactivity indices will be inspected and baseline will be entered into the regression in case it is systematically related to reactivity. To test the need to control for other confounding variables, correlations were calculated between the dependent variables and age, weight, years of experience as a teacher, class size and time used for preparation of the lecture. When there was a significant effect of (one of) the confounders they were entered first in the regression.

Results

Reactivity to and coping with lecturing

Heart rate, cortisol and subjective anxiety responses are shown in Figures 6.1 to 6.3. The repeated measures ANOVA on the *heart rate responses* shows a main effect of period ($F(6,108)= 34.29$, $p <.001$). Post-hoc analyses indicate that the heart rate response at period II and III are significantly higher than the responses at all other periods, whereas the heart rate responses at period I and VII are significantly lower than the responses at all other periods. Mean heart rate baseline is 66.0 bpm (SD= 0.5). All heart rate responses are negatively correlated with the baseline, but this correlation only reaches significance for the heart rate response just before the start of the lecture ($r= -.48$, $p< .05$).

The *cortisol response*, measured after lecturing tends to be somewhat lower than before lecturing ($t= 1.79$, $p= .093$). The mean baseline for cortisol is 9.06 nmol/l (SD= 4.76). Both cortisol responses are negatively correlated with the baseline ($r= -.55$ and $r= -.61$, $p< .01$, before and after lecturing, respectively).

The repeated measures ANOVA on *subjective anxiety* (SA) shows a significant effect for moment ($F(5,90)= 5.26$, $p < .001$). Post-hoc analyses show that the greatest increase in SA is observed at moment 3 but that this increase in

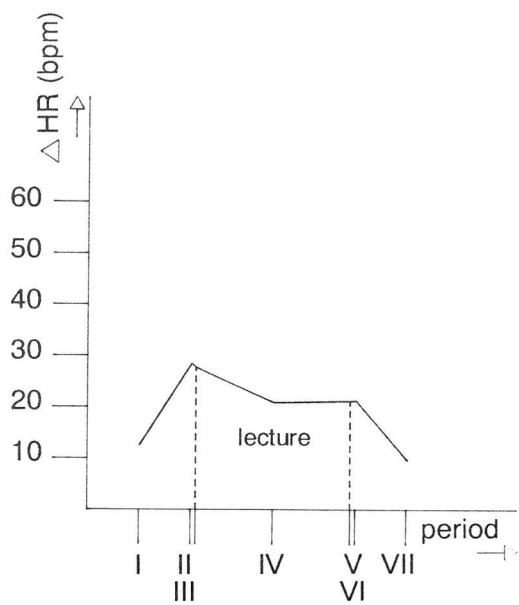

Figure 6.1 : Mean heart rate response for the 7 periods, indicating responses before, during and after lecturing. Period I to VII are the heart rate responses at about 15 minutes before the start of the lecture, just before, at the start of, at the middle of, at the end of, just after and about 15 minutes after the lecture (see also Chapter 2).

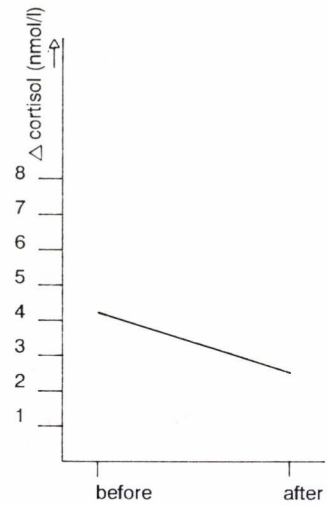

Figure 6.2 : Mean cortisol response before and after lecturing.

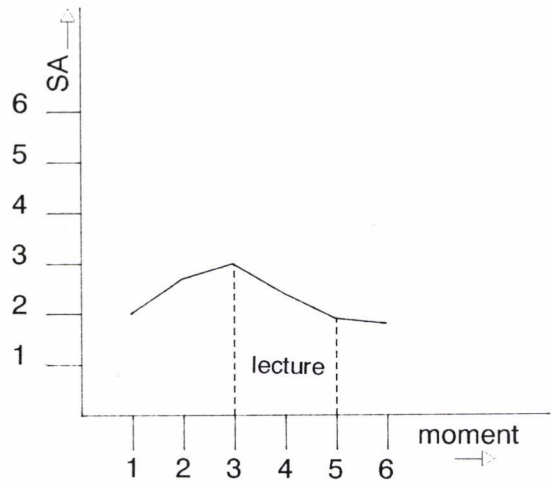

Figure 6.3 : Mean subjective anxiety score for 6 moments, before, during and after lecturing. These 6 moments denote the subjective anxiety on arrival at the Institution, just before, at the start of, at the middle of, at the end of, and after the lecture. Note that the moments 1 to 6 are in fact the moments 5 to 10, from Chapter 2.

SA is not significantly different from the SA at the moments 2 and 4. SA at the moments 1, 5 and 6 are significantly lower than SA at all the other moments.

The correlations between the heart rate and cortisol responses are insignificant. The heart rate responses at periods V to VII are positively correlated with SA at the moments 5 and 6 (correlations range from r= .34 to r= .54, three are significant at p< .05, for the other three there is a tendency for significance: .05 <p< .10). The cortisol response, measured before lecturing is negatively related to SA at all moments. These negative correlations only become significant for the SA at the moments 2, 3 and 4 (the 6 correlations range from r= -.29 to -.56, 2 are significant at p< .05, one at p<.01).

Moderators

In Table 6.1 the mean moderator scores are shown for the experienced teachers.

As far as there are normative standards available, the subjects are close to the normal score, except that they can be considered highly fit for their age (the mean maximal O2 uptake (ml/kg.min) is high; Astrand and Rodahl, 1986, p 335-338), they are low on social anxiety (mean values for different populations, reported by Willems et. al., 1973, range from 39.9 to 49.7; standard deviations range from 12.6 to 18.8), and high on social support seeking behavior and expressing emotions (Schreurs et. al., 1988).

The correlations among the moderators are of potential interest, but are not of core relevance with respect to the present research questions. The correlations can, however, be inspected in appendix IV.

Health (risk) indices

In Table 6.2 means and standard deviations for the CHD risk indices, and indices for subjective well-being are shown.

The mean blood pressures are normal and the lipid profile is within 'normal' range [5]. The scores on the indices for subjective well-being are low, as compared to standards for a healthy population (Luteijn et. al, 1984; Zung, 1965), thus indicating that the subjects have relatively few (psychological and somatic) complaints and have few depressive symptoms.

Correlations among the health (risk) indices are shown in Table 6.3. The responses to the stress of lecturing are also reported in Table 6.3. Only the data of anticipatory reactivity, measured just before the start of the lecture, are reported, as the correlations for the other responses do not add extra information. As heart rate and cortisol responses were (somewhat) related to their baseline, the correlations for heart rate and cortisol baselines are also reported.

The cortisol responses before and after lecturing, but not cortisol baseline, are significantly related to the triglyceride level (for the response after lecturing, r= .47, p< .05). Systolic and diastolic blood pressure are strongly related, and both blood pressures show a significant negative correlation with HDL-cholesterol. Tendencies for positive correlations are found between the blood pressures, LDL cholesterol (systolic blood pressure) and the triglyceride

Table 6.1 Means and standard deviations for the moderators.

moderator		$\bar{X}$	SD
fitness			
PWC150 (Watt)		155.0	39.0
VO_{2max} (l/min)		3.5	.7
(ml/kg.min)		48.0	7.0
HPA (min) [4]			
6 months	very light	4162.8	6539.6
	light	8113.9	6437.4
	medium heavy	8368.0	11406.5
	heavy	1232.6	3461.8
self esteem		25.0	3.3
neuroticism		41.5	20.0
extraversion		57.8	17.2
social anxiety		32.5	14.7
Type A		12.5	3.1
Active problem solving (APS)		19.9	2.7
Palliative responding (PR)		16.8	2.6
Avoidance behavior (AV)		16.8	2.6
Social Support Seeking (SSS)		14.5	3.5
Depressive responding (DR)		11.2	1.8
Emotional Responding (ER)		7.0	1.3
Comforting Cognitions (CC)		11.8	2.6

[4] As is evident in the mean as compared to the standard deviations, the HPA scores are highy skewed. After calculating the sumscore as indication of the energy expenditure over the last 6 months, the distribution is still not normal and a transformation is necessary for the use of this moderator in the regression analyses. Normal probablity plots as furnished by BMDP5D, indicated that an ln-transformation resulted in the best normalization.

[5] Standards for the blood lipids were provided by the laboratory of the Free University Academic Hospital.

Table 6.2 Means and standard deviations for the CHD-risk indicators and indices of subjective well-being

SBP = systolic blood pressure
DBD = diatolic blood pressure
HSCL psy = psychological complaints
HSCL som = somatic complaints
SRDS = (Zung) depression score

index	$\bar{X}$	SD
objective health-risk indices:		
- resting blood pressure (mmHg)		
-systolic	125.01	3.2
-diastolic	82.3	10.6
- cholesterol		
-total (mmol/l)	5.4	1.1
-HDL "	1.4	.3
-LDL "	3.5	.9
- tryglycerides "	1.1	.5
subjective indices:		
- HSCL psy	5.7	4.3
- HSCL som	2.2	2.3
- SRDS (ZUNG)	11.4	5.0

concentration. Total cholesterol is positively related to all its fractions and to the triglycerides. The triglyceride level is negatively related to HDL-cholesterol and tends to be positively related to LDL-cholesterol.

Psychological symptoms and depression are positively related to heart rate baselines, but are negatively related to the heart rate responses as well.

Confounders

Heart rate responses to lecturing are positively associated with class size (mean class size is 33 students, the number of students ranges from 9 to 100) [6]. The correlations, however, only reach significance for the response at the

[6] Class size was transformed to attain normality by:
$-1/\sqrt{}$ (class size).

Table 6.3 Correlations among the heart rate and cortisol baselines, heart rate and cortisol responses and subjective anxiety (just) before the start of the lecture, resting blood pressures, and blood lipids, and the subjective health indices. For abbreviations see Table 6.2.

HR base = heart rate baseline
CR base = cortisol baseline

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. HR base	-													
2. HR period II		-												
3. CR base			-											
4. CR before			-.55**	-										
5. SA moment 2			.47*	-.50*	-									
6. SBP						-								
7. DBD						.84***	-							
8. Total chol.								-						
9. LDL						.39'		.97***	-					
10. HDL						-.58**	-.57**	.35'		-				
11. Triglycerides				.51*		.33'	.33'	.46*	.43'	-.43*	-			
12. HSCL psy	.42*	-.43*									-.33'	-		
13. HSCL som												.53*	-	
14. SRDS	.47											.46*		-

' .05 < p < .10; * p < .05; ** p < .01; *** p < .001

start of the lecture (r= .42, p< .05). The cortisol responses are unrelated to confounders. All subjective anxiety scores are positively related to preparation time [7], but only the correlation for the response at the start of the lecture reaches significance (r= .42, p< .05). Resting blood pressure is positively correlated with age (r= .37, .05 <p< .10 for systolic blood pressure, r= .57, p< .01, for diastolic blood pressure). HDL-cholesterol and the triglyceride level are also correlated with age (r= -.43, and r= .48, p< .05, respectively). LDL-cholesterol tends to relate to weight (r= .31, .05 < p< .10).

The indices of subjective well-being are unrelated to the confounding factors.

Predicting the health (risk) indices

Reactivity to and coping with lecturing

Heart rate, cortisol and subjective anxiety entered the multiple regressions as dependent variables. As physiological reactivity tended to be negatively related to the baselines, baseline was entered first in the regressions on both heart rate and cortisol [8].

The results from the regressions on the reactivity and attunement to, and recovery from the stress of lecturing are shown in Tables 6.4 to 6.6 for heart rate, cortisol and subjective anxiety, respectively.

Heart rate *reactivity* is not very well predicted. Only expressing emotions is positively related to heart rate reactivity about fifteen minutes before the lecture starts. The cortisol response before the lecture tends to be positively associated with self-esteem. Reactivity in subjective anxiety is strongly predicted by extraversion: the more extravert the subject, the less subjective anxiety he reports in anticipation of and at the start of the lecture. Some extra variance is explained by Type A behavior, palliative responding and depressive responding: higher subjective anxiety scores in anticipation of or at the start of the lecture are associated with more Type A behavior, more palliative responding and more depressive responding, respectively.

Attunement in heart rate is greater the lower the scores on self-esteem and the lower the sumscore for habitual physical activities. The cortisol response, measured after lecturing, tends to be lower when the subjects are more Type A, but less 'emotional responding'. Attunement in subjective anxiety is higher when the response at the start of the lecture was higher.

Recovery in heart rate is greater when subjects report to perform more habitual physical activities and report to express less emotions. Recovery of the subjective anxiety response is greater when the response at the end of the lecture is higher.

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[7] Preparation time was transformed to attain normality by:
-1/ (x+ 1).

[8] By this procedure, one does not only correct for the correlation between stress reactivity and baseline, but also for the characteristics that are associated with the baseline. To give the reader some insight in the implicite corrections that were made in this respect, it is noted that heart rate baseline is correlated with physical fitness (r= -.35, .05 < p <.10 and r= -.44, p < .05, for maximal O_2 uptake and PWC150 respectively), self-esteem (r= -.43, p< .05), and neuroticism (r= .39, p < .05). The moderators, related to cortisol baseline are self-esteem and comforting cognitions (r= -.35, .05 < p < .10 and r= -.53, p < .05, respectively).

Table 6.4 Predictors for reactivity, attunement and recovery in heart rate [9]. For abbreviations see Tables 6.3.

	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation I (15 min. before)	1. expressing emotions (+)	4.77*	.23
Anticipation II (just before)	1. baseline (-)	5.07*	.23
Lecturing (start of)	1. class size (+)	3.62'	.16
Attunement	1. self esteem (-)	5.58*	.25
	2. HPAsum (-)	5.18*	.42
Recovery I (just after)	1. HPAsum (+)	7.58*	.29
	2. expressing emotions (-)	5.61*	.45
Recovery II (15 min. after)	-		

Table 6.5 Predictor(s) for the cortisol response before and after lecturing [9]. For abbreviations see Table 6.3.

	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation	1. baseline (-)	7.37*	.30
	2. self-esteem (+)	3.37'	.42
Attunement/ Recovery	1. baseline (-)	9.97**	.37
	2. Type A (-)	3.57'	.48
	3. expressing emotions (+)	4.50'	.60

[9] Predictors are only reported when their contribution was significant ($p < .05$) or tends to be significant ($.05 < p < .10$).

Table 6.6 Predictors for reactivity, attunement and recovery in subjective anxiety [9]. For abbreviations see Table 6.3.

	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Anticipation I	1. extraversion (-)	6.68**	.26
(30 min. before)	2. Type A behavior (+)	4.39'	.41
Anticipation II	1. preparation time (+)	3.71'	.18
(just before)	2. extraversion (-)	9.88**	.49
	3. palliative responding (=)	4.08'	.60
Lecturing	1. extraversion (-)	17.34***	.48
(start of)	2. depressive responding (+)	7.90*	.63
Attunement	1. response at the start of the lecture (+)	21.45***	.56
Recovery	1. response at the end of the lecture (+)	11.15**	.40

Table 6.7 Predictors for the blood pressures [9]. For abbreviations see Table 6.3.

	predictor(s)	$F_{to\ enter}$	R^2_{cum}
SBD	1. active avoidance (+)	4.09'	.18
DBD	1. age (+)	7.54*	.32
	2. neuroticism (+)	6.42*	.52
	3. active avoidance (+)	4.36'	.64
	4. active problem solving (+)	4.62'	.73
	5. fitness (-)	3.63'	.79

Table 6.8 Predictors for the blood lipids [9]. For abbreviations see Table 6.3.

	predictor(s)	$F_{to\ enter}$	R^2_{cum}
Total	1. palliative responding (-)	4.86*	.22
	2. social anxiety (+)	5.65*	.43
	3. active problem solving (+)	5.94*	.59
LDL	1. neuroticism (+)	4.01'	.18
	2. palliative responding (-)	7.20*	.42
HDL	1. age (-)	3.75'	.20
	2. active avoidance (-)	9.23**	.52
	3. extraversion (-)	5.13*	.65
Triglycerides	1. age (+)	5.21*	.23
	2. active problem solving (+)	3.16'	.36

Blood pressures and blood lipids

The results from the regression analyses on the CHD risk indices are shown in Tables 6.7 and 6.8, for the resting blood pressures and the blood lipids, respectively.

High scores on active avoidance behavior are predictive of both high systolic and diastolic blood pressure and low HDL-cholesterol levels. High diastolic blood pressure is also predicted by high neuroticism scores, and to a lesser extent by high active problem solving and low PWC150 scores. Social anxiety and neuroticism are positively related to total and LDL-cholesterol, respectively, whereas palliative responding is negatively related to these indices of CHD risk. Active problem solving is positively related to total cholesterol and shows a tendency for a positive relation with the triglycerides.

Indices for subjective well-being

The results from the regressions on the psychologic and somatic health symptoms and depression are shown in Table 6.9.

The indices for subjective well-being are, to a considerable extent, predicted by neuroticism scores or by related characteristics. Self-esteem is, however, first to enter on depression. Type A behavior is a highly significant predictor for somatic health symptoms. The sumscore for the HPA's is also positively associated with somatic health complaints. Fitness, operationalized as aerobic power comes in third as a negative predictor, but its predictive power is inflated by the HPA sumscore.

Table 6.9 Predictors for the subjective health indices [9]. Fot abbreviations see Table 6.3

	predictor(s)	$F_{\text{to enter}}$	R^2_{cum}
HSCL psy	1. neuroticism (+)	21.68***	.56
	2. Type A behavior (+)	3.20'	.63
HSCL som	1. Type A behavior (+)	8.46**	.35
	2. HPAsum (+)	5.17*	.52
	3. VO2max/kg (-)	10.66**	.67
SRDS	1. self-esteem (-)	12.06**	.46
	2. depressive responding (+)	12.37**	.72

Discussion

The data of the present study show that the stress responses in the experienced teachers followed a pattern that was similar to the one of the male student teachers. In contrast to what was hypothesized on the basis of the study on the student teachers, the analyses showed that heart rate reactivity to and coping with the stress of lecturing in the experienced teachers could not be well predicted, especially not with the predictors that emerged in the previous study. Cortisol responses were, again, predicted by coping styles, although by different ones as compared to those that emerged in the student teachers. Subjective anxiety was mainly predicted by extraversion. As hypothesized, the cortisol responses were associated with the blood lipids, but the correlations were only significant for the triglyceride level. In general, the indices of reactivity to and coping with the lecturing stressor were unrelated to blood pressure, cholesterol levels and the indices for subjective well-being. The objective health risk indices and the indices for subjective well-being were significantly, although differentially predicted by several of the coping styles, neuroticism and self-esteem.

The mean increases in heart rate, cortisol and subjective anxiety do not differ much from those found for the male student teachers in their real lectures at the end of their practice period (see for the student teachers' responses in Chapter 2). Despite this agreement, a difference in response pattern is to be noted. A flattening of both heart rate and subjective anxiety responses is shown in the experienced as compared to the student teachers: the response at the start of the lecture is no longer the highly significant peak response. For the heart rate responses, even a trend of a shift forward in time is shown in the experienced teachers. This finding is partly in accordance with data from Epstein and Fenz (1965) and Fenz and Epstein (1967) who showed a forward shift in physiological responses to the real life stress of a parachute jump when subjects were more experienced. Considerable individual differences were, however, found. In both novices and experienced parachutists, a forward shift was much more pronounced in the 'good' performers, and this forward shift was, therefore, associated with effective coping (Fenz and Jones, 1972). The lecturing performance, also evaluated by an expert, did not result in reliable performance measures (see appendix II). So the conclusion of Fenz, Epstein and Jones as that the forward shift is indicative of effective coping could not be checked with our data.

In the present study, a health perspective was used to indicate effective coping. Hyperreactivity and sustained activation in response to stressors is considered as indicative of ineffective coping and hyperreactivity is hypothesized to be moderated by individual characteristics. In line with the previous findings on reactivity to and coping with the stress of lecturing in the male student teachers, it was hypothesized that fitness and -to a minor extent- neuroticism would predict reactivity in heart rate, that coping styles would predict cortisol responses, and that neuroticism, extraversion and perhaps also the coping styles would predict subjective anxiety. These hypotheses were only partly confirmed. Heart rate baseline, but not heart rate reactivity, was found to be negatively associated with fitness. As epidemiological evidence (see e.g. Powell et. al, 1987) confirms the protective effect of fitness, it might be that heart rate baseline and not heart rate reactivity is the protective factor for CHD. Beere, Glagov and Zarins (1984), for example, showed that a lowered basal heart rate, induced by surgical ablation of the sinoatrial node, had a retarding effect on

coronary atherogenesis in adult male monkeys. Both fitness and aerobic training effects are associated with lower basal heart rates (Astrand and Rodahl, 1986).

Several factors do, however, limit the comparison with the data of the previous study. A first limitation is the fact that, for practical reasons, the experienced teachers were only measured in the real life and not in the standardized lecturing situation. Situational factors that can not be controlled for, might have decreased the predictive power of the moderators. Another limitation is the fact that the comparison is a cross-sectional one, and selection might have taken place. The experienced teachers can be considered a valid reference group for the student teachers who participated in the previous study since the preference for the field of sports and health was present in both student and experienced teachers. The moderator scores, measured in the present study, however, indicate that the subjects in the present study were a select group of persons. The subjects in the present study appeared to be highly fit, low on social anxiety and high in social support seeking and expressing emotions. The fact that these teachers all taught at an institution where sport or health care was a central issue, may partly account for the high fitness scores in the subjects and stresses the fact that these teachers may not be a representative sample for the post-secondary, male teacher. The fact that the experienced teachers were highly fit might have underestimated the predictive, or perhaps even the protective value of fitness. This is illustrated by the findings of Brown and Lawton (1986), Roth and Holmes (1985), and Kobasa, Maddi and Puchetti (1982) who found that stress was only related to health problems in the low fit subjects. The possible protective effect of fitness by means of a hyporeactive response to stress, therefore, cannot be discarded yet.

The regressions on the cortisol responses also provided different coping styles as predictors, in comparison with those that emerged in the previous study. Maybe selection accounts for this finding, too, as subjects were high on social support seeking, the coping style that was associated with a larger cortisol adaptation in the male student teachers. The predictor sets for the cortisol responses in the student teachers were, however, not very consistent. Subjective anxiety responses in the lecturing situation are consistently predicted by extraversion. The associations for extraversion were stronger, and in the same direction as those that were found in the previous study for the male student teachers. The effect of neuroticism on subjective anxiety scores, found in the previous study, had disappeared, but depressive responding emerged in the present study as predictor of subjective anxiety scores at the start of the lecture. Again, it must be noted that the experienced teachers were low on social anxiety, a characteristic that is related to neuroticism.

A selection hypothesis as the explanation for the failure to replicate the main findings of the study on student teachers seems to be quite plausible. The present data suggest that student teachers who experience lecturing, a main aspect of the professional task in post-secondary education, as stressful or taxing, will not enter the profession, or leave the profession at an early stage. These latter options are especially attractive when there are other opportunities for a professional career, and unemployment is not impending. Since comparison between the present and previous study is cross-sectional, these conclusions must, however, be considered hypothetical.

The present study showed little systematic relation between the indices for reactivity to and coping with the lecturing stressor and the other health (risk) indices, except for a relation between the cortisol response and the triglyceride resting level. The correlation between the increase in cortisol can be considered salient as the responses (and not the cortisol baseline) both before and after lecturing are positively associated with the triglycerides. This, despite a tendency for an overall decrease in cortisol excretion across the lecture. In a review of the literature on stress, cholesterol and coronary heart disease, Troxler and Schwertner (1985) state that whether stress, or the stress induced cortisol response, results in a rise in serum cholesterol or triglycerides, may depend upon the duration of the stress.

As may be hypothesized on basis of the literature, age is positively associated with resting blood pressures and with the triglycerides, and negatively with HDL-cholesterol (e.g. McKinney et. al, 1987; Troxler and Schwertner, 1985). Of interest in the present study, however, was the finding that the moderators of the present study significantly predicted blood pressure and cholesterol resting values. Avoidance behavior was positively associated with resting blood pressures and negatively with HDL-cholesterol. Active problem solving is -although to a minor extent- also positively associated with diastolic blood pressure, total cholesterol and the triglycerides. Palliative responding is negatively associated with total and LDL-cholesterol. These findings suggest that the active coping styles (avoidance behavior and -to a minor extent- active problem solving) are related to the CHD risk, whereas a passive coping style (palliative responding) is related to a cholesterol profile that is associated with low CHD risk. The fact that avoidance behavior is associated with illness is in accordance with findings of prospective studies by Cronkite and Moos (1984), and Holahan and Moos (1986), although these studies only measured indices for subjective well-being. In a meta-analysis by Suls and Fletcher (1985), avoidant coping was found to be beneficial on a short term but not on a long-term perspective. Non-avoidant coping was, however, found to be beneficial on both the short and the long-term. Active problem solving may, in their definition, be considered a 'non-avoidant' coping style. Active coping is, however, a controversial coping style, as active problem solving is especially considered beneficial in situations which are perceived as amenable to change (Folkman et. al., 1986). Holahan and Moos (1986), for example, also reported that subjects who often used active problem solving, reported to be more often confronted with negative stressful life events.

The fitness related measures came into the regressions on the health (risk) indices, several times. The direction of the two biological measures was one indicating that a somewhat lower health risk was associated with higher fitness scores. The predictions are, however, not very convincing. Although hypothesized, fitness was not found to be related to any of the cholesterol fractions. In a study on stressed physicians and dentists, McKinney et. al. (1987) also reported fitness to be unrelated to cholesterol. Their subject population was, like ours, highly fit. The failure to find significant protective effects for fitness might, again, have to do with the fact that the present subject population was highly fit.

The negative contribution of self-esteem to depression, on the other hand, was rather strong and is consonant with the literature on this topic (Bosscher, 1985). The sumscore for HPA was, however, positively related to somatic health complaints. Within a group of highly fit subjects, this finding is ambiguous. A higher somatic health complaint score may include, for example, psychosomatic complaints, but may include complaints caused by sport injuries as well.

All indices for subjective well-being were, however, strongly predicted by neuroticism, depressive responding and Type A behavior. In a recent meta-analysis, Type A behavior as measured by self-report, was found to be correlated with chronic dysphoric emotions (Suls and Wan, 1989). Watson and Pennebaker (1989) showed that self-report measures of both stress and health contain a significant component that is associated with subjective distress or negative affect, such as measured by questionnaires on neuroticism, depression, anger or hostility. Correlations between such measures are therefore likely to overestimate the true association between stress and health. Both Watson and Pennebaker (1989) and Costa and McCrae (1987) showed that persons high on negative affect or neuroticism report many health complaints but are not the kind of person that has a high mortality risk or shows more objective indications of disease. In the present study, however, neuroticism is found to be related to some objective indices of CHD risk as well. A meta-analysis performed by Friedman and Booth-Kewley (1987), showed that there might be something like an objectively definable 'disease-prone personality', as subjects that are high on anxiety, depression, anger, hostility or aggression had an increased (but aspecific) risk to suffer from CHD, asthma, ulcers, arthritis or headaches.

The conclusions, drawn from the data in the present study can be summarized in the following points:

- The stress responses in the experienced teachers followed a pattern that was similar to the one of the male student teachers. However, a flattening effect was observed as well as some indication of a forward shift in the peak heart rate response;
- The predictor set for the subjective anxiety scores showed agreement with the findings in the previous study on the student teachers. Although the coping styles again predicted the cortisol responses, the coping styles that emerged were different from the ones that were found as predictors in the previous study. The heart rate responses, which were best predicted in the student teachers, could not be predicted very well in the experienced teachers;
- The subjects were a select group of people with respect to several moderators: they were high on fitness, social support seeking behavior and expressing emotions, and low on social anxiety. This might have inflated the predictive power of these moderators for reactivity to or coping with the stress of lecturing as well as the predictive power for several of the other health(-risk) indices. These findings might also indicate that a selection process has taken place;
- Reactivity appeared to be rather unrelated to the other health(-risk) indices, except for the cortisol response. The relation between cortisol and the triglycerides confirms the suggested (indirect) role of cortisol responses in the development of CHD.
- Prediction of the blood pressures and cholesterol resting levels by the moderators, especially the coping styles, appeared to be significant. Active coping styles were found to be predictive of an increased health risk, whereas passive coping was found to be associated with a reduced health risk.
- The indices for subjective well-being were related to a general dimension of subjective distress.

Chapter 7
GENERAL DISCUSSION

Summary of aims and main findings

The research which is presented in this thesis first aimed to describe the physiogical and psychological responses to the stress of lecturing in student teachers who practiced lecturing at a post-secondary institution for about three months. Of special interest was the adaptation across the practice period in which coping will take place. The second aim of the present research was to explain individual differences in the responses to and coping with the stress of lecturing with stable personal characteristics which were hypothesized to act as stress moderators. The student teachers, all participated in a teacher education programme, and were measured in both real lectures at the post-secondary institution and in standardized lectures at the training institute, at the beginning of and at the end the practice period at the post-secondary institution. Stress responses were operationalized as increases in heart rate, cortisol excretion, and subjective anxiety.

The underlying assumption of measuring the heart rate and cortisol responses to the lecturing stressor was that exaggerated physiological responses to stressors or sustained physiological activation mark or mediate pathological processes. For both heart rate and cortisol excretion, human and animal experiments indicate that increases in these variables may be both directly and indirectly associated with coronary heart disease (CHD) risk (e.g. Eliot, 1979; Krantz and Manuck, 1984; Manuck et. al, 1983, 1989; Troxler and Schertner, 1985; Ursin, 1980). Cortisol has also found to be associated with subjective feelings of distress and to be negatively related to subjective well-being (Dienstbier, 1989; Frankenhaeuser, 1983; Hofer et. al., 1972; Ursin et. al, 1978; Vickers, 1988; Wolff et. al, 1964) and may additionally contribute to immunological diseases as it is found to be associated with immunosuppression (e.g. Calibrese et. al, 1987; Sklar and Anisman, 1981).

The stability of the stress responses was of special interest as this stability is considered crucial for hyperreactivity in order to be considered a potential marker or mediator of pathology. Individual differences in responses to, and coping with intrinsically motivating stressor(s) counteract stability of the responses.

Stress and coping in lecturing, and stability in responses

The physiological and psychological responses, measured in the present study, indicated that lecturing imposed a severe load on the student teachers. Practice induced a highly significant adaptation in the responses to both the real and to the standardized lecturing stressor across a period of three months. Despite this adaptation, the responses to both the real and the standardized lecture were found to show considerable stability in the sense that student teachers who were hyperreactors before practice were very likely be still hyperreactors after practice. This stability was observed for both absolute and difference scores, indicating that the 'additional' responses itself were considerably stable.

The stability in responses to lecturing, especially for the heart rate responses, appeared to be a very robust phenomenon, and was only affected to a very minor extent by environmental confounders such as differences in class size and in audience status. The finding of stability in responses may have considerable relevance to the hypothesis that hyperreactivity to stressors, particularly those one is frequently confronted with, may induce or promote the development of disease. If the hyperreactive student teachers would enter the teaching profession, they are hypothesized to have a relatively high CHD-, or other health risk. It must, however, be noted that the three stress responses were only found to be weakly related, or not related at all, indicating that the 'high heart rate reactors' were not the same persons as the 'high cortisol reactors' or the 'high subjective anxiety reactors'. This may have implications for the specific health risk of the student teachers when they keep to be regularly confronted with the lecturing stressor.

Prediction of individual differences in stress and coping with lecturing

From stress theories, it is predicted that relatively stable person characteristics may moderate the stress-illness relationships. The moderators measured were personal characteristics which were, according to the stress literature, either found to be associated with indices of stress reactivity, or with illness or disease. At the biological level, sex and fitness were measured, and at the psychological level neuroticism, extraversion, (social) anxiety, Type A behavior, and the coping styles of active problem solving, palliative responding, avoidance behavior, social support seeking, depressive responding, expressing emotions, and comforting cognitions were measured.

In the present research, sex differences were found to be salient, both with respect to the predictor sets that emerged in the regressions on the responses that indicated stress and coping to lecturing, as with respect to the correlations among several of the moderators. With respect to these latter correlations, sex differences were apparent when they concerned Type A behavior or the coping styles. Of special notice is the fact that these were all predictors which were assumed to be most susceptible to training or socialization influences. To illustrate the sex differences, Type A behavior was stronlgly related to expressing emotions in the males, but not in the females. Also, the coping style of comforting cognitions showed a positive relation to active problem solving and extraversion in the females, but was positively related to palliative responding (a passive coping style) and tended to be negatively related to extraversion in the males. These findings were interpreted as to support the notion that the same characteristics may have a different moderating potential in the stress-illness relationships for men and women.

The predictor sets which emerged for heart rate, cortisol and subjective anxiety responses, measured in the standardized lecturing situation were not only different for males and females, but were also quite different for the three stress indices. This latter finding might have been anticipated on the basis of the low correlations between these indices. Hyporeactive heart rates were mainly associated with high fitness scores in the males, whereas they were mainly associated with high extraversion scores in the females. The cortisol responses were mainly predicted by the coping styles, different ones for males and females. Low subjective anxiety responses in the males were mainly

predicted by low scores on neuroticism, high scores on extraversion, and by several coping styles, whereas low scores on social anxiety, together with some of the coping styles, were predictive of low subjective anxiety in the females.

The predictor sets appeared to be quite consistent, in particular the ones for the heart rate responses. This consistency in predictor sets for the responses at the beginning of and at the end of the practice period, together with the stability in responses to lecturing across practice, suggest that one can predict to a considerable extent which persons will still be highly taxed by lecturing after a practice period, and who will best adapt to the stress of lecturing across practice on the basis of their (relatively stable) characteristics. It must be noted that the predictive power of these moderators appeared to be greater after practice, especially for the physiological responses.

Stress and coping in experienced teachers

On the basis of the finding of a more intimate relation of moderators and lecturing responses after practice, it was hypothesized that the moderators would be even more intimately related to or predictive of health-risk when subjects would enter the teaching profession and become more experienced. To see if evidence for such a hypothesis could be provided, a pilot study was performed measuring the responses to the lecturing stressor in experienced, male teachers, appointed at post-secondary institutions. This study, however, failed to support the hypothesis of an intimate relationship between the moderators and physiological reactivity to the lecturing stressor in experienced (male) teachers. A selection hypothesis was proposed, as the experienced teachers were high on fitness, high on the coping styles of social support seeking and expressing emotions, and were low on social anxiety. Except for the coping style of expressing emotions, the moderators on which the experienced teachers differed from normative standards appeared to be significant predictors of reactivity to lecturing in the study on the student teachers. For the male student teachers, high fitness scores were found to predict hyporeactive heart rate responses to the lecturing stressor and also a larger adaptation in heart rate. The coping style of social support seeking was found predictive of lower cortisol responses after practice and larger adaptation in cortisol excretion and subjective anxiety, and characteristics that were indicative of anxiety (social anxiety and neuroticism) had been found predictive of high subjective anxiety scores. This suggests that student teachers who experience lecturing as taxing or stressful, do not enter the teaching profession or leave the profession at an early stage.

Limitations of, and questions arising from the present research

The findings of the present research, especially those in the student teachers, were pronounced and consistent. A strong point is the fact that the measurements were performed in situations with high ecological validity. A consequence of this was, however, a considerable loss of physiological data, in particular of the heart rate data.

The stability in responses and their consistent prediction by person characteristics, especially those that are amenable to change, raise the question as to

the beneficial effects of fitness training, or training which is directed to increase, for example, social support seeking behavior in male student teachers, or to influence some of the other coping styles in order to increase the individual's moderating (or adaptive) capacity. When moderators can be changed, and if a change in moderator score is associated with changes in stress effects, this may have practical implications for teacher training. A selection of the literature which addresses the effects of moderator training will be presented in this discussion.

A salient finding, to be noticed when inspecting the responses to the stress of lecturing in the student and experienced teachers (Fig. 2.4 to 2.6 and Fig 6.1 to 6.3), is the fact that the responses to the lecturing stressor, measured in the experienced teachers do not seem to be lower than those measured in the student teachers after practice. Testing this suggestion for the three response parameters, measured in the male student teachers after practice and in the male experienced teachers with repeated measures ANOVA's for all three dependent variables, confirms this suggestion. This lack of difference in responses to lecturing is especially salient as the experienced teachers had not only practiced lecturing for at average 10 years, they were also considerably older as compared to the student teachers. Psychophysiological studies indicate that heart rate reactivity to stressful situations is found to decrease with age (Gintner, Hollandsworth, and Intrieri, 1986; Matthews and Stoney, 1988). There may be several explanations for this finding.

Responding to the stress of lecturing and teacher stress

Several explanations may be posed for the lack of a significant difference in stress responses between the male subjects that either practized for 3 months, or for (at average) 10 years. First, the relatively high responses in the experienced teachers may be due to the fact that they generally lectured to larger classes (see Chapter 6). This explanation is, however, not very likely since class size was only found to be predictive for heart rate, and, as far as it was predictable, it accounted for only a small part of the variance to be explained. Payne and Rick (1986) suggest that although heart rate, measured in occupational settings, may be explained by psychological stress to some extent, these responses mainly indicate physical activity and an increase in metabolic demand. The failure to find differences in heart rate responses between male student teachers after lecturing and experienced teachers may then indicate that this heart level just reflects the metabolic demand of lecturing. It is, nevertheless, claimed that a part of the stress responses, measured in both student and experienced teachers are caused by psychological effects of the lecturing stressor. All responses, including anticipatory heart rate, measured already 15 minutes before lecturing, anticipatory cortisol excretion and also subjective anxiety scores, were significantly elevated in the experienced teachers. Additionally, anticipatory heart rate, anticipatory cortisol, and subjective anxiety were partly explained by psychological moderators. The coping style of 'expressing emotions' was found predictive of a high anticipatory heart rate response which was measured about 15 minutes before lecturing, a delayed heart rate recovery, as well as a high cortisol response, measured after lecturing. Apart from these findings, the experienced teachers in the present study were

found te be high on this coping style of expressing emotions. The coping style of expressing emotions may itself be associated with hyperreactivity to psychological stressors. Recently, Suarez and Williams (1989) found an increased emotional reactivity (indicated by high state anger and irritation) to be associated with enhanced cardiovascular reactivity, but only in men who were high in (trait) hostility. The items which constitute the coping style of 'expressing emotions', as used in the present research, mainly pertain to the expression of anger. This coping style may therefore be interpreted as a tendency to express anger. Matthews and Haynes (1986) pointed out that the majority of JAS-items (Type-A items) which discriminated the myocardial infarction cases from the controls, concerned anger and hostility. A meta-analysis on prospective population based studies indicated that hostility significantly predicted CHD-incidence (Matthews, 1988). If physiological hyperreactivity really predicts health risk, the hyperreactive experienced teachers, who are also high on the coping style of expressing emotions may therefore be hypothesized to be at health (probably CHD-) risk.

In teachers, especially in post-secondary teachers, stress on the job has hardly been related to (physiological) hyperreactivity, moderators, and subjective and objective health indices. A series of experiments on experienced primary and secondary teachers by Kinnunen (e.g. 1987, 1988) has, however, some relevance to the present discussion, since they do not primarily address the sources of stress, but the degree of experienced stress throughout an autumn term, and its relation to several moderators in these teachers. Kinnunen (1987, 1988) discriminated four types of teachers on the basis of a clustering on self-reported mood throughout an autumn term: teachers who were (1) exhausted throughout the term, (2) those who recovered from stress on the first weekends of the term but not lateron, (3) those who were not stressed at all, and (4) teachers who felt tired and anxious only at the beginning and end of the term. Differences in coping styles and neuroticism were found between these groups. 'Type 1' teachers did not suppress difficulties, reported emotional coping styles in stress situations and used rational coping styles least. 'Type 2' teachers were average in all respects and coping styles were equally used. 'Type 3' teachers were least neurotic and adopted a rational coping style most often. 'Type 4' teachers used either emotional or social coping styles (Kinnunen, 1988). These findings indicate that the teachers who have an 'emotion expressive coping style' will experience most subjective distress throughout the school year, or, together with 'social coping styles', experience high distress at the beginning and at the end of an autumn term. As noted before, the coping style of expressing emotions was high in the group of experienced teachers, measured in the present research.

As the behavioral styles of hostility, (expression of) anger, or (lack of) assertiveness have found to be susceptible to environmental stimuli (Pedersen et, al, 1989), training programmes, directed at coping styles which have an emotional coping function, may have benefits for its associated health risk.

Practical implications: effectiveness of moderator training

In the present study on student teachers, it was found that reactivity (both psychologically as well as physiologically) was reduced after a three month

training which was specific to the job. The question, addressed in this Section will be directed to the possible benefits of an aspecific training programme which is directed to either cognitive or emotional coping skills, or to aerobic training aimed at reducing short-term or long-term (health) effects of stress. If these, more or less aspecific, training programmes can be considered effective in addition to specific teacher training, it might be recommendable to implement them in teacher training programmes for student and maybe also for experienced teachers.

Fremouw and Zitter (1978) evaluated such specific and aspecific training programmes for speech anxiety. The effects of *specific skills training*, including videotape feedback, intonation, eye contact, gestures, and speech organization, were compared to effects of less specific cognitive coping techniques which included *cognitive restructuring* and *relaxation coping skills*. An important improvement of both subjective and behavioral measures of speech anxiety was found for both the specific and aspecific skills training. The improvements were shown to be maintained for a two months follow-up period. The study showed a tendency for differential effects of the two training programmes for subjects who differed in social anxiety. The specific skills training programme was found equally effective for all subjects, whereas the cognitive restructuring-relaxation programme appeared to be more effective for subjects high on social anxiety. Helin and Hanninen (1987) showed that a *relaxation programme* reduced EMG, systolic and diastolic blood pressure responses to a teaching test to a greater extent in Type A as compared to Type B student teachers (physical education teachers). Although reducing speech anxiety may not be a relevant training issue for experienced teachers as anxious subjects probably already have left the profession by then, these findings may well have relevance for teacher education. In a study which was directed at coping skills training in psychology students, Smith (1989) found that a training programme which was directed to the training of *cognitive* and *emotional coping* reduced both trait and state measures of anxiety and increased self-efficacy.

These training studies suggest that coping skills can be effectively trained and that subjective stress measures can be reduced. Their effect will, however, be most beneficial for subjects who are high in social anxiety and report or show Type A behavior.

As physical fitness is often found to be associated with physiological hyporeactivity to psychosocial stressors, and to subjective and objective well-being, *aerobic training* studies have been undertaken as to study causal relation(s) between aerobic fitness and short and long term stress effects. The findings of aerobic training studies do, however, not support a causal relation between aerobic fitness and hyporeactivity to psychological stressors, or show highly inconclusive findings (see for well conducted studies: Cleroux et. al, 1985; De Geus et. al., 1990; Seraganian et. al, 1987; Sinyor et. al, 1986).

The studies investigating the effect of aerobic training on Type A behavior and related constructs are as inconclusive as the effects of aerobic training on physiological reactivity. These studies were instigated by the findings of Blumenthal et. al. (1980) which indicated that Type A scores (but not Type B scores) were lowered after aerobic training. Jasnoski, Cordray, Houston and Osness (1987), and also Blumenthal et. al. (1988) replicated this finding, and Blumenthal et. al. (1988) even found that cardiovascular reactivity to psychosocial stressors was reduced after training. Roskies et. al (1986) and Takashi (1981), however,

did not find a reduction in Type A behavior after aerobic training. Roskies et. al. (1986) also failed to support the aerobic training effect on cardiovascular reactivity. In this latter study, however, a behavioral stress management programme did effectively reduce the Type A subcomponents (e.g. hostility and competitiveness) and the Type A total score.

The effects of aerobic training on self-report measures of stress and well-being appear to be somewhat more consistent. These studies, though, are often performed on either highly stressed, highly depressed or highly anxious subjects (e.g. Blumenthal et. al, 1989; Doan and Sherman, 1987; Hughes, 1984; Long, 1984). Aerobic training is often associated with higher self-esteem, higher self-efficacy, and less state anxiety. Recently, the effect of aerobic training of different intensities on subjectively reported well-being was studied (Moses et. al., 1989). This well-controlled study indicated that the positive effects of aerobic training were independent from the training effect on maximal oxygen uptake, and was only significant for the training programme of moderate, but not high intensity.

Bruning and Frew (1987) studied the effect of *exercise, relaxation,* and *management skills training,* both singular and in combination, on physiological resting levels over a total period of about 20 weeks. They found that each of the programmes led to decreases in resting pulse rate and systolic blood pressure, all programmes were equally effective. Dual combinations of the programmes after 13 weeks (whatever the combination) led to additional decreases in heart rate. Long (1988) studied stress management in primary and secondary school personnel. This stress management programme was either constituted by sole stress-inoculation training (mainly affecting emotional coping), or a combination of stress-inoculation training and a minimal aerobic exercise programme. The aerobic training programme did not result in an increase in aerobic power. Only the combined programme resulted in a significant reduction of teachers stress and trait anxiety. Emotional coping, however, was decreased in both training groups. The strongest effects were shown for those subjects that were high on anxiety and low on fitness, prior to beginning the training programme.

The literature discussed above can be summarized as that aspecific training studies which were aimed either to influence cognitive or emotional coping, or aerobic fitness resulted in decreases of subjectively reported stress or increases in subjectively reported well being. The aerobic training studies which aimed to reduce short term physiological reactivity to stressors were inconlusive. Both aerobic training and relaxation or management skills training were found to result in decreased physiological base levels. These literature findings may have relevance for future research on the stress of lecturing and well-being in general, since the predictors which showed up in the present study can be effectively changed, indicating an increased moderating capacity of the individual. There is thus far, however, few consistent evidence that physiological reactivity can be effectively reduced by way of affecting stress moderators. Only practice appears to affect physiological reactivity and sustained activation, as caused by the stressor. In the present study, though, the physiological (and psychological) responses were shown to be considerably stable.

Directions for future research on the stress of lecturing

The data of the present research prompt to further study on the stress of lecturing and the moderators of the responses, their prospective health risk or their selection potential in(to) the teaching profession. When the present research is continued, there are several directions to take, all of these include a longitudinal type of design. The questions, arising from the present study, however, not only pertain to the description of stress and coping with the lecturing task and either its predictive power or that of the moderators (or their combination) for selection and health risk. The question of training effectiveness of either fitness, coping skills or styles, or a combination of these is interesting from a practical perspective. Training, either aerobic training or behavioral stress management may be expected to have beneficial effects on subjective responses which are indicative of well-being and to several personal characteristics like trait anxiety, self-esteem, and Type A behavior, including its subcomponents of hostility and competitiveness.

Some aspects deserve special attention in such a follow-up. In order to understand the way in which sex differences play a role in the stress-moderator-illness-relationships, i.e. to investigate if indeed the stress-illness relationships are moderated, or even mediated differently for men and women, both sexes should be studied in a follow-up. A large, and representative group of experienced teachers should be measured in order to see if self-selection is important with respect to selection in(to) the job for both male and female teachers. Other, external factors may also be important with respect to selection in(to) the job, and sex differences may be present, as well. Recent statistics on the number of teachers, employed in post-secondary institutions indicate that only 22 % of the post-secondary teachers is female (CBS, 1989). Apart from the fact that there are, at average, less women employed as a teacher in this type of education, the female teachers have less teaching hours, compared to male teachers (59 % of a full time job for the females, as opposed to 77 % of a full time job for the males). There may be many reasons for this, but none of these will be elaborated on, here. The percentage of female teachers, however, employed at the different post-secondary institutions where the student and experienced teachers either practized, or were employed, ranged from 19 to 51 percent. This suggests that females may have a different chance to become employed at the different institutions.

Another salient conclusion, to be drawn when inspecting these statistics on post-secondary teaching personnel (CBS, 1989), is that many post-secondary teachers do not stay on the job for a long time. The statistics indicate that in the years of 1986/'87 and 1987/'88 the influx and efflux of teachers was about equal, and constituted about 16 % of the total teaching personnel. Teachers older than 54 years of age only contribute to the efflux for some 15 %. The main influx, but also the main efflux was constituted by teachers in the age group of 35 to 45 (45% and 40% to influx and efflux, respectively). The younger teachers, younger than 35, were next to contribute to both influx and efflux of the teaching personnel (about 30% and 25% to influx and efflux, respectively). The questions as to what reasons underly the early leave from the post-secondary teaching profession, and whether there is a difference (psychophysiologically) between 'stayers' and 'leavers' are interesting ones.

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APPENDICES

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The Anxiety Thermometer: A Validation Study

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The aim of our study was to provide validation and reproducible data for the anxiety thermometer. This thermometer is either a continuous or a 10-point Likert-type scale on which subjects are asked to rate their anxiety feelings at a particular moment. It is a quick way to measure state-anxiety. As a validation criterion the State-Trait Anxiety Inventory (STAI) A-State scale was used. To test the reproducibility of the thermometer, a test-retest correlation coefficient was calculated, with a retrospective second thermometer score. The ego-threatening situation used was a written examination. Two experiments were carried out during different examination conditions. The data consistently indicated that the validity and reproducibility of the anxiety thermometer is fair (correlation coefficients between .60 and .78). In the second study, the possible influence of two factors on the retrospective scores were additionally tested.

INTRODUCTION

In many clinical intervention studies (e.g., Girodo & Roehl, 1978; Karst & Trexler, 1970; Vrolijk, 1979) or studies concerning real life stressors, (Baddeley & Idzikowski, 1985; Gould, Horn, & Spreeman, 1983; Rule & Traver, 1983) the anxiety thermometer, a continuous or a 10- (or 11-) point Likert-type rating scale, has been used to assess state-anxiety. It is surprising that no psychometric data on the validity and reproducibility of this rating scale seem to be available. The purpose of our study was to remedy this situation.

Two versions of the anxiety thermometer are used: one using the adverb *anxiety*, and the other using *nervous*. To assess their concurrent validity, the A-State scale of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) was used as a criterion. To assess its reproducibility, the anxiety thermometer was completed just before the confrontation with an ego-threatening stressor—a written examination—and again just after finishing this examination. In the latter case, the instructions explicitly referred to (among others) the moment just before the examination when subjects completed the

thermometer for the first time. The retrospective reporting of state-anxiety is, according to the STAI Manual, valid provided that the feelings are recent and the precise period for which the state-anxiety responses are desired is emphasised in the instructions (Spielberger et al., 1970).

EXPERIMENT 1

Method

The study was carried out during a written examination by second-year students of the Faculty of Human Movement Sciences. Ninety-one students completed the questionnaires (45 women and 46 men). The mean age of the students was 22.3 years ($SD = 2.3$).

Before the examination, students completed one of the two versions of the anxiety thermometer, the Dutch version of the STAI (A-Trait and A-State scale of the ZBV; Van der Ploeg, Spielberger, & Defares, 1980).

The anxiety thermometer consists of a 10 cm continuous scale, ranging from *not at all anxious/nervous* (the left end), to *extremely anxious/nervous* (the right end). The order in which the STAI and anxiety thermometer had to be completed was randomized. In the instructions for the anxiety thermometer, students were asked to place a cross on the continuum to indicate how they felt at that particular moment. For data analysis purposes, the scale was later divided into 10 equal parts and a score of 1 to 10 was assigned as a measure of the reported feelings.

The anxiety version was completed by 48 students (27 women and 21 men) and the nervous version by 43 students (18 women and 25 men).

After completing the examination, students filled in the anxiety thermometer once again. However, this time they were required to indicate how they felt at 10 separate moments (before, during, and after the examination), among which was the moment just before the examination when they completed the questionnaires for the first time. For each moment, a separate anxiety thermometer was completed. The students who completed the nervous version before the examination received this version again after completing the examination. This procedure was also applied to the anxiety version.

The effect of sex, version, and the moment (before and after the examination) at which the anxiety thermometer was completed was tested using a repeated measures analysis of variance (ANOVA). Pearson correlation coefficients were calculated in order to quantify the association between the anxiety scores measured with the anxiety thermometer before and after the examination and the STAI A-State.

Results

The thermometer scores recorded before and after the examination and the scores on the STAI A-Trait and A-State scales are given in Table 1. To test the reproducibility of the anxiety thermometer, a repeated measures ANOVA was carried out on the thermometer scores with the score obtained before and after the examination as repeated measures. This 2 (Sex) × 2 (Version) × 2 (Moment) ANOVA with moment as repeated measures only showed a significant sex effect, $F(1, 87) = 6.68$, $p < .05$. The women produced significantly higher scores then the men. No main or interaction effects were found for version or moment.

The Pearson correlation coefficients between STAI A-Trait, STAI A-State, and anxiety/nervous scores before and after the examination for both sexes are shown in Table 2. Initially, the correlations for the two versions were also calculated. However, because they were similar to the correlations reported in Table 2 and because the ANOVA had not shown a significant main or interaction effect for version, these correlations are not reported separately.

Discussion

The first question of the study was concerned with the validity of the anxiety thermometer and the second with its test-retest reliability. Its validity can be considered to be fair because its correlation with STAI A-State ranged from .63 to .77 across sex and version (with higher convergence for women) as compared to only .20 to .25 with STAI A-Trait. It can also be concluded that the reliability is fair because the test-retest reliability coefficients were, roughly, .60 to .70 across sex and version. From the ANOVA and the (lack of differences in) the correlations calculated for the two versions (anxious and nervous), it can be concluded that the descriptive terms used in the anxiety thermometer are equally suited.

TABLE 1
Mean Values for the STAI A-Trait, STAI A-State, and the Thermometer Scores Before and After the Exam for the Whole Group[a]

Before	*Group*	*Women*[b]	*Men*[c]
STAI A-Trait	34.2	34.5	33.5
STAI A-State	41.9	44.5	39.3
A-thermometer	3.6	4.3	2.7
N-thermometer	4.0	4.4	3.6
After			
A-thermometer	3.8	4.6	2.9
N-thermometer	3.5	3.8	3.3

[a]$N = 91$. [b]$n = 45$. [c]$n = 46$.

TABLE 2
Pearson Correlation Coefficients Between STAI A-Trait, STAI A-State, and Thermometer Scores Before and After the Exam for Both Sexes

	Women[a]			
	1	*2*	*3*	*4*
STAI A-Trait	–	.45***	.25*	.20
STAI A-State		–	.77***	.67***
A/N before			–	.68***
A/N after				–
	Men[b]			
	1	*2*	*3*	*4*
STAI A-Trait	–	.51***	.33*	.34
STAI S-State			.69***	.64***
A/N before			–	.68***
A/N after				–

Note. A/N = anxious or nervous.
[a]$n = 45$. [b]$n = 46$.
*$p < .05$. ***$p < .001$.

Because our study resulted in correlations that are only fair (the correlations account for about 50% of the variance), a replication study was carried out. In replicating the experiment, it is not only possible to examine the consistency of the results already obtained but the opportunity is also provided to examine two factors which, intuitively, may have influenced the test–retest reliability coefficients. One factor is the feeling of success or failure, occurring during the examination when it turns out to be more or less difficult than expected. This feeling, when it occurs, might influence the retrospective thermometer scores. The second and more methodological factor pertains to the way in which the retrospective questionnaire is constructed. When the students are asked to rate their feelings for successive moments in time, the anxiety scores may be fitted into a particular pattern. The score for one of the moments (probably the moment that caused the strongest feelings) might then, explicitly, become a reference for the scores at the other moments in time. This would not be the case if the students were asked to rate retrospectively their feelings experienced at just one moment in time.

EXPERIMENT 2

Method

Once again, measurements were carried out during a written examination by students of the Faculty of Human Movement Sciences. On this occasion, the

subjects were first-year students, none of whom had participated in the first experiment. Questionnaires were completed by 83 students (42 women and 41 men). The mean age was 21.2 years (SD = 3.2).

Before the examination, the anxiety version of the anxiety thermometer, the Dutch version of the A-Trait Scale and A-State scale of the STAI (ZBV) were completed. The anxiety thermometer was a 10-point Likert-type rating scale, ranging from *not at all anxious* (1) to *extremely anxious* (10). Again, the order in which the STAI and the anxiety thermometer were completed was randomized. After completing these two questionnaires, the students were asked to rate the mark they expected to get for the examination on a 5-point scale, ranging from *very bad* (1) to *very good* (5).

After finishing the examination, the students were asked to complete the anxiety thermometer once again. Half of the sample (n = 41) was asked to rate their feelings for 10 separate moments (just as in Experiment 1). The other half of the sample (n = 42) was required to complete an anxiety thermometer which only referred to the moment at which they completed the questionnaires before the examination. After completing the anxiety thermometer, all students were again asked to rate the mark they expected to get for the examination they had just finished. The difference between the mark that the students expected to get when asked before and after the examination was taken as a measure of the "uplift" or "set-back" they had experienced during the examination. The students were also asked to rate the difficulty of the examination on a 5-point scale, ranging from *very easy* (1) to *very difficult* (5). As an objective indication of the examination performance, the marks actually attained at the examination were registered and also used in the data analysis.

For data analysis the same statistics were used as in Experiment 1.

Results

A repeated measures ANOVA, 2 (Sex) × 2 (Type of Anxiety Thermometer Completed After Finishing the Examination) × 2 (Moment Before and After the Examination) with moment as repeated measure, showed that the thermometer scores obtained after the examination were higher (M = 3.6; for women, M = 3.7; for men, M = 3.4) than those obtained before the examination (M = 3.2; for women, M = 3.5; for men, M = 2.9), $F(1, 79) = 4.09$, $p < .05$. There was a tendency for a higher score on the 10-moment anxiety thermometer (M = 4.2; for women, M = 4.0; for men, M = 4.4) compared to the 1-moment thermometer (M = 3.1; for women, M = 3.5; for men, M = 2.6), $F(1, 79) = 3.71$, $p = .058$.

The Pearson correlations between the anxiety thermometer scores measured before and after completing the examination, STAI A-Trait, and A-State scores are similar to the correlations found in the first experiment for both sexes (the correlations between STAI A-State and the thermometer scores were .69

and .70 for women before and after the examination, respectively, and .63 for men both before and after the examination; test–retest reliability correlations were .70 for women and .58 for men). The correlations calculated for the two anxiety thermometers completed after the examination (10 moments and 1 moment) hardly differered from one another and from the the correlations just reported. Correlations between the anxiety scores (STAI A–Trait, A–State, and thermometer scores) with the expected mark (before and after the examination and the difference between these two), the perceived difficulty and the mark that was actually obtained for the examination, were not significant (the correlations ranged from −.23 to .17).

Discussion

The correlations reported in the replication study between the STAI A–State scores and the thermometer scores before and after finishing the examination confirm the validity and reproducibility of the anxiety thermometer. It can be concluded that the anxiety thermometer is a valuable instrument for measuring A–State in an ego-threatening real-life situation, such as an examination. The descriptions *anxious* and *nervous* are equally suited for this short questionnaire.

It should be noted, however, that the correlations between the anxiety scores on the thermometer and the STAI A–Trait are somewhat lower than those between the STAI A–State and the A–Trait. Holtzman (1976) stated that the high correlation between the STAI A–Trait and A–State might be attributed to content overlap of items, common method variance, and true commonality of the A–State and A–Trait concepts. Ramanaiah, Franzen, and Schill (1983) showed that the correlation between A–State and A–Trait is inflated due to the presence of items with low content saturation on these scales. Content saturation is said to be high for an item when the item's correlation with its own scale is greater than that with the irrelevant scale (Ramanaiah et al., 1983). Because common method variance, content overlap of items, and low content saturation do not pertain to the relation between the STAI A–Trait scale and the thermometer, a relatively low correlation could be expected.

The reproducibility of the thermometer scores is not only consistent but fair. The second experiment was concerned with the evaluation of two factors that might have specifically influenced the retrospective thermometer score. Perceived difficulty of the examination, anticipated marks, or the marks actually attained do not seem to be related to the anxiety scores after the examination, thus providing support for the validity of a measurement procedure in which feelings of anxiety that are experienced before the stressful event are reported after this event has taken place. However, a tendency was shown for a higher thermometer score on the 10-moment thermometer compared to the 1-moment thermometer. Because the first experiment, in which only the 10-moment thermometer was used, did not produce higher scores in the retrospective

measurements and the high scores in the second experiment are primarily due to the high scores of the men who filled in the 10-moment thermometer in this experiment, we considered this effect of thermometer structure artefactual.

As indicated by the main and interaction effects of sex in the ANOVAs, sex is an important factor with respect to reporting feelings of anxiety. Also, the women consistently show higher validity and test–retest reliability correlation coefficients. The higher subjective responsiveness for women is in accordance with the literature (e.g., Houtman & Bakker, 1987; Lewis, Ray, Wilkinson, Doyle, & Ricketts, 1984; Van der Ploeg et al., 1980). One of the explanations is that women are more open than men, as measured by means of a self-disclosure questionnaire (Hatch & Leighton, 1986). This would imply that women are more ready to report their feelings than men. It is suggested that this sex difference in responsiveness might, therefore, be seen as a report artefact (Levenson, Hirschfeld, Hirschfeld, & Dzubay, 1983). It is also suggested that the higher subjective responsiveness of women is due to sex-role related socialization experiences (Buck, 1981). Because men tend to report lower anxiety scores than women, their scoring range will be smaller than that found for women. Correlation coefficients will generally be lower when the range of the data set on which they are based is smaller. Despite a difference in subjective responsiveness, physiological responsiveness is not found to be different for men and women (Houtman & Bakker, 1987; Lewis et al., 1984) or is even found to be lower for women (Frankenhaeuser et al., 1978). From these results it is suggested that women cope with a threatening situation in a different way.

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APPENDIX II
II.1 RELIABILITY OF LECTURING PERFORMANCE RATINGS

Introduction

In an attempt to evaluate interindividual differences and intra-individual changes in lecturing performance, the lectures of the student teachers were evaluated with an observational instrument, a rating scale, based on the one which was designed by Van Hout, Mirande and Smuling (1981). As no psychometric data have been reported for this rating scale, several reliability estimates are computed for the somewhat adapted scale in the present research project.

The rating scale has to be completed by students, or other observers, just after attending the lecture, and is constituted by items which either pertain to organizational skills, or to presentational skills, necessary to design and present a lecture. Some of the items also pertain to the interaction with students (e.g. answering and posing questions). In the present research, the rating scale is extended with three items. Two items ask the observer to rate the overall quality of the lecture and the quality of the teacher. This was done as some researchers found the accuracy in the measurement of practical skills to be as good as or even better for global items, as compared to more specific criteria (Houpt and Kress, 1973). A third item was added which asks the observer to rate the teachers's anxiety. Since Blase (1986) reported that self-perceived stress was associated with subjectively reported, debilitating effects on self-evaluated performance, it was found interesting to test the correlations among observed anxiety and observed lecturing performance. Bakker (1987) reported systematic negative correlations between observed performance and observed anxiety when skilled dancers were observed, even when the observations were peformed by experts. The observational instrument, used in the present research is shown (in Dutch) in Appendix II.2.

The indices, used as estimates of reliability are intra- and inter observer reliability, determined from ratings of real life as well as videotaped lectures. First of all, however, the dimensionality of the ratings is studied to test if observers are really able to discriminate organizational and presentational lecturing skills. When homogenous factors are discerned, the ratings on the items which load on that factor can be considered as repeated measures of that factor. An averaged score of the items which load on that factor must be considered more reliable than the single-item ratings (e.g. Houpt and Kress, 1973). With respect to the present research, the ratings for the student teachers are most interesting. Since lecturing performance may be expected to change across a period of practice (see e.g. the recent review by Kulik and Kulik, 1989), being able to measure increases in lecturing performance adds to the validity of the rating scale. When evaluating lecturing performance of the student teachers in the real lecturing situation, however, the order in which the lectures are rated is confounded with the (possible) effects of practice. All lectures in the standardized lecturing situations were videotaped. By having experts rate the lectures, presented on these videotapes in a randomized order, it was possible to disentangle the effect of observation order and the effect of practice. Video-

tapes of the same lecture could be rated twice as well. To minimize suspicion, care was taken that the observer did not rate the same lecture or another lecture by the same student teacher again, before at least six other lectures of 30 minute duration had been rated. The observers were informed that they probably would rate more than one lecture by the same student teacher, that the lectures performed at the beginning and at the end of the practice period would be shown in a randomized order, and that they would even sometimes rate these student teachers for the third time (the re-test).

As experienced teachers, who did not participate in a teacher training programme, were assumed to have a rather consistent lecturing performance, student ratings of experienced teachers were used to determine the stability (test-retest) of the real life lecturing performance ratings. Marsh (1987) indicated that the mean rating score, a 'class-averaged' score, is a more reliable indicator of teacher performance than ratings of a single observer. Reliability coefficients reported in his review are about r= .20 at single observer level. The reliability of class-averaged responses depend upon the number of students. When reliability is about .20 for only one student, it is estimated to be .60 for the average of five students, .74 for the average of 10 students, and .90 for the average of 25 students. In his own studies, agreement was found to be about r= .80 or higher for class-averaged responses (Marsh, 1987; p 257 to 277). It has to be noted, though, that these correlations pertain to 'end-of term' ratings, and not to ratings of specific lectures.

In this appendix, reliability estimates will be reported for single observer ratings by an expert of the videotaped lectures by student teachers and for single- and class-averaged student ratings of real lectures by experienced teachers. First, however, dimensionality of the rating scale is determined for student ratings of real life lectures by both student and experienced teachers, in order to determine if specific dimensions of item-averaged scores should be determined. After reporting several reliability estimates, practice effects will be reported for the student teachers on the basis of the videotaped lectures, and correlations will be inspected between the performance and anxiety ratings for the lectures by student and experienced teachers.

Procedure

Assessment of lecturing performance in the student teachers real lectures

The first and last lectures of the student teachers, delivered at the post-secondary institution, were evaluated by both the students and the supervisor who attended the lecture. As ANOVA's did not indicate a difference between a student-averaged and the supervisor ratings, these ratings were not discriminated in the analyses.

For 34 student teachers, at average 22 observers (students and supervisor) evaluated the first and last lecture (the number of observers per lecture ranged from 3 to 60). A total number of 1516 ratings were obtained, but only 1407 observers rated all items.

Videotaped, standardized lectures

All standardized lectures were videotaped. A total of 138 videotapes of the standardized lectures (including the double ratings), either performed at the beginning of, or at the end of the practice period, were rated by two observers who had educational expertise. The order of the first and second lectures was randomised in order to disentangle the effects of observation order and practice. A total of 22 videotaped lectures were rated twice. One of the observers rated 19 lectures twice, the other one re-rated just three lectures. For only the first observer, test-retest reliability correlations will be reported. The two observers rated 10 videotaped lectures which were exactly the same. These ratings were used to determine inter-observer agreement. Both observers were unacquainted with the student teachers.

Assessment of lecturing performance in experienced teachers

For the assessment of reliabilities in real life ratings of experienced teachers' performances, both the single-rater and the class-averaged rating strategy were followed. First, nineteen students at the same post-secondary institution were asked to rate the same experienced teacher in the same type of lecture, with exactly one week in between the two ratings. The student was asked to deliver the completed rating scale immediately after each evaluation. Second, 19 experienced, post-secondary teachers were evaluated with the rating scale by the whole class of students. When the number of students exceeded the number of fifty students, about 40 to 50% of the students was asked to rate the teacher, since this percentage if found to result in an acceptable indication of rating (McBean and Lennox, 1985). At average 18 students rated a single lecture (the number ranged from 3 to 57). A total of 579 students rated the experienced teachers, but only 235 students rated all items. The teachers were rated by the students after two lectures. Both lectures were the first lectures to be performed on a particular working day. The two lectures which were rated, were delivered within a period of two weeks.

Results

Dimensionality of lecturing performance

The dimensionality of lecturing performance was evaluated by application of a factor analysis to the performance ratings for the real lectures by student and experienced teachers, separately, as well as for the videotaped lectures. It was hypothesized that observers are able to discriminate observational items which pertain to organizational skills, from items which pertain to presentational skills. Since some items specifically refer to interaction between teacher and students, a third dimension, indicative of this interaction might be found as well. The factor analysis on the ratings of the student teachers in the real lecturing situation resulted in only one factor with an eigenvalue greater than one. This factor explained 56.1 % of the variance in the ratings (the eigenvalue = 3.27). The factor analysis on the ratings of the experienced teachers (n = 235) resulted in one strong factor, explaining 48.8 % of the variance (eigenvalue = 3.38), and one small factor, explaining 16 % of the variance (eigenvalue = 1.11). Factor analysis of the videotape ratings (student teachers' lectures) also resulted in one strong factor, explaining 41.1% of the of the variance in the ratings, and

three minor factors, explaining 20.8, 14.9, and 13.6 % variance, respectively (eigenvalues were 3.92, 1.98 and 1.41, respectively). These four dimensions can, however, not well be described on the basis of the items with the highest factor loadings.

Crombach alpha's for the performance ratings of the real and videotaped lectures by the student teachers were .76. For the ratings of the experienced teachers, Crombach alpha was .81. Homogenity of the rating scale as a whole (without the anxiety ratings) was therefore considered to be satisfactory. Inclusion of the two global items did not make any difference.

Intra-rater reliability and inter-rater agreement of videotaped lecturing

Intra-rater reliability was operationalised as test-retest reliability in the ratings from the videotaped, standardized lectures. The test-retest reliability of the single-item ratings (including the global ratings) range from r= -.42 to .58. The test-retest reliability of the item-averaged score is r= .57 ($p < .05$; the anxiety rating is not included). The second time a same lecture is rated, the item-averaged score is, however, significantly lower (T= -2.32, $p < .05$).

Inter-rater agreement at item-level also ranges from r= -.59 to .56. The inter-rater agreement of the item-averaged score is r= .38, p=.282).

Test-retest reliability in experienced teachers

The single-rater test-retest reliability for the 19 students at single-item level ratings of real lectures ranges from r= -.27 to .97 (2 test-retest ratings are significant, 1 at $p< .001$, and 1 at $p< .05$). The test-retest reliability of these 19 raters for the item-averaged score is r= .14 (p= .565).

The test-retest correlations for the class-averaged ratings for the nineteen experienced teachers ranges from r= -.04 to .80 at single-item level (mean correlation is r= .41; 9 of the 20 correlations are significant, 4 at $p< .05$, 5 at $p< .001$; the observed anxiety rating was not included). The test-retest reliability of the item-averaged score was r= .46 ($p<.05$). There was no statistical difference between the mean item-averaged score for the first and second lecturing performance.

Observation order and practice effects

The standardized lectures were tested for effects of observation order and of practice. A repeated measures ANOVA was performed on 23 ratings of videotaped lectures, performed at the beginning of, and at the end of the practice period. In 9 cases, the 'beginning of practice' lecture was rated first, in the other 14 cases the 'end of practice' lecture was rated first. ANOVA's were performed on both the single-items, and on the item-averaged score. None of these ANOVA's, however, showed a main effect of observation order, nor of practice.

Correlations between performance and anxiety ratings

Table II.1 shows correlations between the two global ratings for the quality of the lecture, the quality of the teacher, and the item-averaged score on the one hand, and the anxiety ratings for the student and experienced teachers on the other.

Table II.1 The relationship between observed anxiety and observed lecturing performance

	Observed anxiety			
	Experienced teachers		**Student teachers**	
	real lecture lecture		standardized lecture	real lecture
	single rater scores n = 38	class-averaged scores n = 38	single rater scores n = 138	single rater scores n = 1561
lecture quality rating	-.07	-.29*	-.41***	-.21***
teacher quality rating	-.42*	-.30*	-.40***	-.20***
item-averaged ratings	-.37*	-.36*	-.42***	-.23***

The correlations, shown in Table II.1 indicate that there seems to be a systematic bias in the performance rating by the observers. Observed anxiety is negatively related to observed performance. The observed anxiety appears to be either low or unrelated to self-perceived anxiety. For the 19 experienced teachers who were rated by the whole class, the class-averaged rating of perceived anxiety tended to be related to the self-perceived anxiety of the teachers ($r = .29$, $.05 < p < .10$). Self-perceived anxiety is unknown for the 19 teachers who have been rated twice by the same (single) student. For the student teachers' ratings, correlations between self-perceived anxiety and observed anxiety by single observer ratings (only calculated for the supervisors) range from $r = -.56$ to 1.00. Class-averaged anxiety ratings in real life lecturing are not significantly correlated to self-perceived anxiety ($r = .07$). The correlation between anxiety ratings for the videotaped lectures, and self-perceived anxiety is low, but significant ($r = .22$, $p < .01$). For the videotape ratings, also the correlations between self-perceived anxiety and observed lecturing perfor-

mance was inspected. These correlations were, however, insignificant (correlations range from r= -.05 to -.11).

Conclusions

The reliability estimates on the rating scale, as have been determined in the present research, indicate that:

- the rating scale on lecturing performance is to be considered a one-factor ratings scale;
- the rating scale did not demonstrate a significant change in lecturing performance for the student teachers;
- single-item ratings, or item-averaged ratings of lecturing performance by a single observer must be considered unreliable, whereas item-averaged and observer-averaged ratings of lecturing performance show low, but significant reliability;
- Lecturing performance ratings can be considered biased by observed anxiety.

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APPENDIX II.2

VRAGENLIJST DOCENTENGEDRAG IFLO DOCENTENOPLEIDING

naam docent :
datum :

Instructie:
Hieronder staat een aantal vragen over het de les dat u zojuist gevolgd heeft. Bij elke vraag staat een schaal met vijf antwoordmogelijkheden. Wilt u bij iedere vraag het cijfer omcirkelen dat het beste uw mening over het college weergeeft. Wanneer u geen mening heeft of als u vindt dat de vraag niet van toepassing is, wilt u dat dan aangeven in het daarvoor bestemde rondje?

n.b. Deze beoordeling wordt uitsluitend gebruikt ten behoeve van het onderzoek aan de docentenbeoordeling.

voorbeeld:

vraag:
Was het handschrift van de docent
leesbaar? zeer goed 5-4-3-2-1 zeer slecht
geen mening/n.v.t. 0

daarbij is 5 = zeer goed
4 = goed
3 = niet goed maar ook niet slecht
2 = slecht
1 = zeer slecht

Vond u de docent goed leesbaar schrijven, omcirkel dan 4

1. Wat is de algemene indruk van het college?	zeer goed 5 - 4 - 3 - 2 - 1 geen mening/n.v.t. 0		zeer slecht
2. Wat is uw algemene indruk van de docent?	zeer goed 5 - 4 - 3 - 2 - 1 geen mening/n.v.t. 0		zeer slecht
3. Vond u de docent angstig of gespannen?	zeer angstig of gespannen geen mening/n.v.t. 0	5 - 4 - 3 - 2 - 1	in het geheel NIET angstig of gespannen
4. Was het voor u gemakkelijk of moeilijk een duidelijke, grote lijn in de les te ontdekken?	zeer makkelijk geen mening/n.v.t. 0	5 - 4 - 3 - 2 - 1	zeer moeilijk

5. Was het voor u tijdens de les les het onderscheid tussen hoofd- en bijzaken duidelijk of onduidelijk?	zeer duidelijk 5 - 4 - 3 - 2 - 1 zeer onduidelijk geen mening/n.v.t. 0	
6. Was het gebruik van het bord overzichtelijk of onoverzichtelijk?	zeer overzichtelijk 5 - 4 - 3 - 2 - 1 zeer onoverzichtelijk geen mening/n.v.t. 0	
7. Waren de gebruikte overhead sheets overzichtelijk of onoverzichtelijk?	zeer overzichtelijk 5 - 4 - 3 - 2 - 1 zeer onoverzichtelijk geen mening/n.v.t. 0	
8. De docent had de studenten meer bij de les moeten betrekken dan hij/zij deed.	zeer mee eens 5 - 4 - 3 - 2 - 1 zeer mee oneens geen mening/n.v.t. 0	
9. De docent had meer gelegenheid tot het stellen van vragen moeten geven dan hij/zij deed.	zeer mee eens 5 - 4 - 3 - 2 - 1 zeer mee oneens geen mening/n.v.t. 0	
10. De docent had beter op de vragen en opmerkingen van studenten in moeten spelen dan hij/zij deed.	zeer mee eens 5 - 4 - 3 - 2 - 1 zeer mee oneens geen mening/n.v.t. 0	
11. Vond u de presentatie van de de les eentonig of afwisselend?	zeer eentonig 5 - 4 - 3 - 2 - 1 zeer afwisselend geen mening/n.v.t. 0	
12. Kon u de docent goed of slecht verstaan?	zeer goed 5 - 4 - 3 - 2 - 1 zeer slecht geen mening/n.v.t. 0	
13. Was het tempo waarin de docent les gaf voor u te hoog, te laag, juist goed? (indien juist goed, 3 omcirkelen)	veel te hoog 5 - 4 - 3 - 2 - 1 veel te laag geen mening/n.v.t. 0	
14. Kon u uw aandacht er tijdens de les goed of slecht bijhouden?	zeer goed 5 - 4 - 3 - 2 - 1 zeer slecht geen mening/n.v.t. 0	
15. Vond u de inhoud van de les makkelijk of moeilijk te begrijpen?	zeer makkelijk 5 - 4 - 3 - 2 - 1 zeer moeilijk geen mening/n.v.t. 0	
16. Kreeg u tijdens de les voldoende of onvoldoende gelegenheid om aantekening te maken?	ruim voldoende 5 - 4 - 3 - 2 - 1 ruim onvoldoende geen mening/n.v.t. 0	
17. Gebruikte de docent voor u onbekende en verder niet uitgelegde termen?	zeer veel 5 - 4 - 3 - 2 - 1 zeer weinig geen mening/n.v.t. 0	

18. Straalde de docent enthousiastme uit?	zeer veel 5 - 4 - 3 - 2 - 1 zeer weinig geen mening/n.v.t. 0	
19. Had de docent veel of weinig oogcontact met de studenten?	zeer veel 5 - 4 - 3 - 2 - 1 zeer weinig geen mening/n.v.t. 0	

OPMERKINGEN:

APPENDIX III.1

Mean moderator scores and standard deviations for the subjects, for who complete heart rate registrations were available in the standardized lecturing situation.

moderator	men n=17		women n=22	
	mean	sd	mean	sd
fitness -PWC170 (Watt)	212.0	43.5	155.4	39.1
N	40.3	18.7	52.4	22.9
E	57.9	13.6	60.0	15.4
SA	37.0	9.3	40.1	12.2
Type A	14.4	4.2	12.9	4.4
AP	21.9	2.8	21.3	3.4
PR	15.0	2.4	19.0	2.7
AV	16.1	2.9	17.4	3.1
SSS	13.0	2.7	11.8	2.6
DR	10.6	2.0	11.8	3.1
ER	6.5	1.9	7.0	1.4
CC	6.4	1.9	7.3	2.0

Appendix III.2

Correlations among the moderators for the male student teachers, whose responses were predicted in Chapter 5.

men: n=17	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. PCW170	-											
2. neuroticism		-										
3. extraversion			-									
4. social anxiety			.61**	-								
5. Type A					-							
6. APS						-						
7. PR					-.38'		-					
8. AV					-.39'		.41*	-				
9. SSS				-.37'					-			
10. DR		.59*								-		
11. ER					.57*	.58*			.49*	.37'	-	
12. CC			.39'		-.40*		.64**	.42*				-

Appendix III.3

Correlations among the moderators for the female student teachers whose responses were predicted in Chapter 5.

women n=22	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. PCW170	-											
2. neuroticism	-.41*	-										
3. extraversion			-									
4. social anxiety		-.52**		-								
5. Type A					-							
6. APS						-						
7. PR			.32'				-					
8. AV			-.44*	.45*	-.36*			-				
9. SSS									-			
10. DR		.66**		.39*	-.32'			.44*		-		
11. ER				-.34'			-.36*				-	
12. CC						.67**			.48**		-.34'	-

Appendix IV

Correlations among the moderators for the experienced teachers.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. PCW150	-														
2. VO2max/kg.min	.63***	-													
3. HPAsum	.60**		-												
4. self-esteem				-											
5. neuroticism		-.35'		-.40*	-										
6. extraversion					-.31'	-									
7. social anxiety				-.41*	.50*	-.51*	-								
8. Type A					.38'			-							
9. APS		.41*						-.32'	-						
10. PR	.44*		.38'							-					
11. AV									-.37'	.40*	-				
12. SSS	.62**	.45*	.42*						.39'	.45*		-			
13. DR					.71***		.37'	.38'		.44*			-		
14. ER											-.35'		.44*	-	
15. CC	-.50*	-.63**					-.44*	.33				-.44*			-

STRESS EN COPING BIJ COLLEGEGEVEN
Een studie naar stabiliteit van stressreacties, individuele verschillen en stress moderatoren

Samenvatting

Doel van het onderzoek, waarvan in dit proefschrift verslag wordt gedaan, was op de eerste plaats het beschrijven van de psychologische en fysiologische stressreacties van aankomende HBO-docenten, voorafgaand aan, tijdens en na afloop van collegegeven, en de aanpassingen hierin als gevolg van een schoolpracticumstage. Op de tweede plaats had het onderzoek tot doel om individuele verschillen te verklaren in de stressreacties op het collegegeven en in de aanpassingen die in deze reacties optreden in de loop van de schoolpracticumstage. In dit verband werd vooral het verklarend vermogen van stabiele persoonskenmerken onderzocht.

In hoofdstuk 1 worden de onderzoeksvragen geformuleerd en wordt een theoretisch kader gepresenteerd waarbinnen gezocht is naar antwoordmogelijkheden op deze vragen. Vervolgens wordt de keuze van de in het onderzoek gemeten stressreacties toegelicht, te weten: de hartfrequentierespons, cortisolrespons en gerapporteerde angst, en wordt hun mogelijke rol in de relatie tussen stress en gezondheid besproken op basis van relevante literatuur.

In hoofdstuk 2 wordt een beschrijving gegeven van de stressreacties die zijn gemeten voorafgaand aan, tijdens en na afloop van het collegegeven, bij de aankomende HBO-docenten, en van de aanpassing in deze responsen na afloop van de stage. Ook wordt de stabiliteit van de responsen nagegaan. De proefpersonen (de aankomende docenten) volgden een 'docentenopleiding'. In het kader van de schoolpracticumstage van deze opleiding gaven zij colleges aan studenten van HBO-instellingen ('echte lesgeefsituaties'). Bovendien verzorgden zij aan het begin en aan het eind van die stage een college aan enkele medestudenten en twee universitaire stafleden ('gestandaardiseerde lesgeefsituatie'). De metingen werden uitgevoerd in zowel de echte als in de gestandaardiseerde lesgeefsituaties.

Het lesgeven in het schoolpracticum en in de gestandaardiseerde lesgeefsituatie bleek aanzienlijke fysiologische en psychologische reacties bij de aankomende docenten teweeg te brengen. Aan het eind van de stage zijn de hartfrequentierespons, de cortisolrespons en de gerapporteerde angst significant minder dan aan het begin van de stage. Dit geldt voor de reacties in beide lesgeefsituaties. Bij een controlegroep die geen schoolpracticumstage volgde, maar voor het overige vergelijkbaar was met de groep aankomende HBO-docenten, bleken de stressreacties voorafgaand aan en tijdens het tweede gestandaardiseerde college niet te zijn afgenomen. Dit resultaat geeft steun aan de conclusie dat de afname in stressreacties bij de aankomende docenten een gevolg is van de ervaring met het lesgeven die in het schoolpracticum is opgedaan.

Hoewel er sprake is van een significante reductie in de stressresponsen aan het eind van de schoolpracticumstage, zijn de correlaties tussen de responsen gemeten aan het begin van de stage en aan het eind van de stage aanzienlijk. Deze hoge correlaties zijn voor beide lesgeefsituaties gevonden, waarbij voor cortisol de aantekening moet worden gemaakt dat de correlaties alleen significant zijn als rekening wordt gehouden met het 24-uurs ritme. Ook de correlaties tussen de responsen in de echte en in de gestandaardiseerde lesgeefsituaties

zijn aanzienlijk. De correlaties tussen de hartfrequentierespons, de cortisolrespons en de gerapporteerde angst onderling, zijn over het algemeen niet significant.

Geconcludeerd wordt dat de mate waarin gereageerd wordt op de lesgeefstressor, een betrekkelijk stabiele eigenschap van iemand is, maar dat deze reactiviteit specifiek is voor een bepaalde stressrespons. In de gestandaardiseerde lesgeefsituatie bleken de stressresponsen sterker dan in de echte lesgeefsituatie. Dit resultaat was niet verwacht, omdat het aantal toehoorders in de echte lesgeefsituatie veel groter was dan in de gestandaardiseerde lesgeefsituatie. Een verklaring voor de verschillen in de stressreacties tussen beide situaties is gezocht in het feit dat de toehoorders in de gestandaardiseerde situatie als meer 'beoordelend' werden ervaren. In het onderzoek dat in hoofdstuk 3 is beschreven zijn de effecten van de aanwezigheid van toehoorders, en met name toehoorders die verschillen in status (die te maken heeft met de mate waarin zij als evaluerend/beoordelend worden ervaren) nader onderzocht.

De groep proefpersonen die deelnam aan het onderzoek, beschreven in hoofdstuk 3, bestond uit bijna afgestudeerden die de docentenopleiding hadden voltooid. Een aantal van de proefpersonen uit het onderzoek dat in hoofdstuk 2 werd beschreven deed ook aan dit onderzoek mee. Als afhankelijke variabelen zijn de hartfrequentie en gerapporteerde angst voorafgaand aan, tijdens en na afloop van lespresentaties gemeten. Tevens werd een prestatiemaat voor de presentaties bepaald. Effecten van de manipulatie van de status van de toehoorders bleken echter marginaal voor de hartfrequentierespons en de prestatie, en afwezig voor de gerapporteerde angstscores. De hartfrequentierespons van de proefpersonen die hun presentatie verzorgden zonder dat toehoorders aanwezig waren, was significant lager dan die van degenen die hun presentatie in aanwezigheid van toehoorders gaven. De groep die hun presentatie verzorgde voor toehoorders met een 'hoge status' (twee onderwijskundigen, werkzaam aan de VU) bleek aan het eind van de presentatie nog een significant hogere hartfrequentierespons te hebben dan de groep waarbij geen toehoorders aanwezig waren. Van de groep die de presentatie verzorgde aan toehoorders met een 'lage status' (twee studenten) lag de hartfrequentierespons tussen die van de andere twee groepen in. De prestatie was het slechtste voor diegenen die hun presentatie gaven zonder dat toehoorders aanwezig waren, en was het beste voor hen die hun presentatie hielden voor toehoorders met een lage status.

In de hoofdstukken 4 tot en met 6 staan de individuele verschillen in responsen op het collegeven centraal.

In hoofdstuk 4 staan sexeverschillen in zogenaamde stress moderatoren centraal. Moderatoren zijn kenmerken of condities zoals de lichamelijke conditie, persoonlijkheid of sociaal-economische status, maar ook sexe, die als 'adaptieve capaciteit' interacteren met stressoren en de (korte en lange termijn) stresseffecten beinvloeden. In dit onderzoek zijn alleen de persoonsgebonden moderatoren op het biologisch en psychologisch niveau onderzocht. Er bleken opvallende sexeverschillen te bestaan, niet alleen in absolute niveaus van enkele stressmoderatoren, maar tevens in de samenhang tussen de moderatoren onderling. Met name de onderlinge correlaties tussen Type A en de diverse copingstijlen, alsmede de correlaties tussen deze kenmerken en verschillende persoonlijkheidstrekken, verschillen aanzienlijk tussen mannen en vrouwen. Mogelijke implicaties van deze sexeverschillen voor een sexe-speci-

fieke rol van Type A en van de copingstijlen in de relatie tussen stress en ziekte zijn besproken.

In hoofdstuk 5 worden de samenhangen tussen de stressmoderatoren en de fysiologische en psychologische stressreacties tijdens het collegeven door de aankomende docenten in de gestandaardiseerde lesgeefsituatie besproken. De voorspellende waarde van de verschillende moderatoren wordt nagegaan voor de verschillende stressreacties aan het begin en aan het einde van de schoolpracticumstage en tevens voor de aanpassing die optreedt als gevolg van deze stage. Ook hierbij werden opvallende sexeverschillen waargenomen. Bij de mannen was fysieke fitheid de belangrijkste voorspeller van de hartfrequentiereactie, terwijl dit bij de vrouwen extraversie was. Bij beide sexen kwamen vooral copingstijlen naar voren als voorspellers van de cortisolrespons. Bij mannen bleek met name de copingstijl 'sociale steun zoeken' een grotere aanpassing in de cortisolrespons te voorspellen. Subjectieve angst tenslotte, bleek vooral door sociale angst en neuroticisme te worden voorspeld.

In hoofdstuk 6 wordt de vraag gesteld of de persoonskenmerken die de stressrespons bij de aankomende docenten voorspelden, ook bij een groep docenten die reeds enige jaren als HBO-docent werkzaam is, de fysiologische en psychologische reacties op het collegegeven voorspellen. De metingen die in hoofdstuk 6 zijn beschreven werden alleen uitgevoerd bij mannelijke HBO-docenten. De stressmoderatoren die bij de mannelijke aankomende docenten als belangrijke voorspellers van de stressreacties naar voren kwamen, bleken deze responsen bij de groep ervaren docenten niet te voorspellen. Wel bleken de ervaren docenten (gezien hun leeftijd) relatief fit te zijn, hoog te scoren op 'sociale steun zoeken' en laag te scoren op sociale angst. Juist deze moderatoren hingen bij de aankomende mannelijke docenten met een minder grote hartfrequentierespons (hogere fitheid), cortisolrespons (meer 'sociale steun zoeken') en geringere subjectieve angst (lage neuroticisme en sociale angst scores) als reactie op de lesgeefstressor. De verklaring voor het feit dat deze kenmerken bij de ervaren docenten de stressreacties niet voorspelden, werd gezocht in een 'zelf-selectie' hypothese: die personen die zich tijdens een docentenopleiding (relatief) zwaar belast voelen door het lesgeven zullen het beroep niet ingaan of er snel weer uitgaan.

In het laatste hoofdstuk zijn de onderzoeksresultaten samengevat en worden enkele suggesties voor vervolgonderzoek gedaan.

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